

PARACLINICAL MADE EASY



SUPPORTED BY
VIDEO LESSONS ON CD

X-RAYS

CLINICAL PATHOLOGY

ECG



MAHMOUD SEWILAM

KASR AL-AINY SCHOOL OF MEDICINE
CAIRO UNIVERSITY

SECOND
EDITION

VISIT...

LANZAROTE
Caliente.COM

Index

X-Rays

Heart	1
Chest	15
Bone	31
GIT & Urology	50

CT-Scan

CT scan Head	70
--------------	----

Clinical Pathology

Hematology

Blood	73
-------	----

Nephrology

Urine analysis	82
Kidney function tests	86
Acid – base balance	88

Hepatology

Liver function tests	90
Hepatitis markers	94

Endocrinology

Oral glucose tolerance test = DM	98
Adrenal function tests	102
Thyroid function tests	103

Neurology

CSF analysis	105
--------------	-----

Cardiology

Myocardial infarction	108
-----------------------	-----

Serology & infections

Widal test	110
Immunology e.g. Rheumatology; RA, SLE	111

Gastroenterology

Stool analysis	113
----------------	-----

ECG

ECG	115
-----	-----

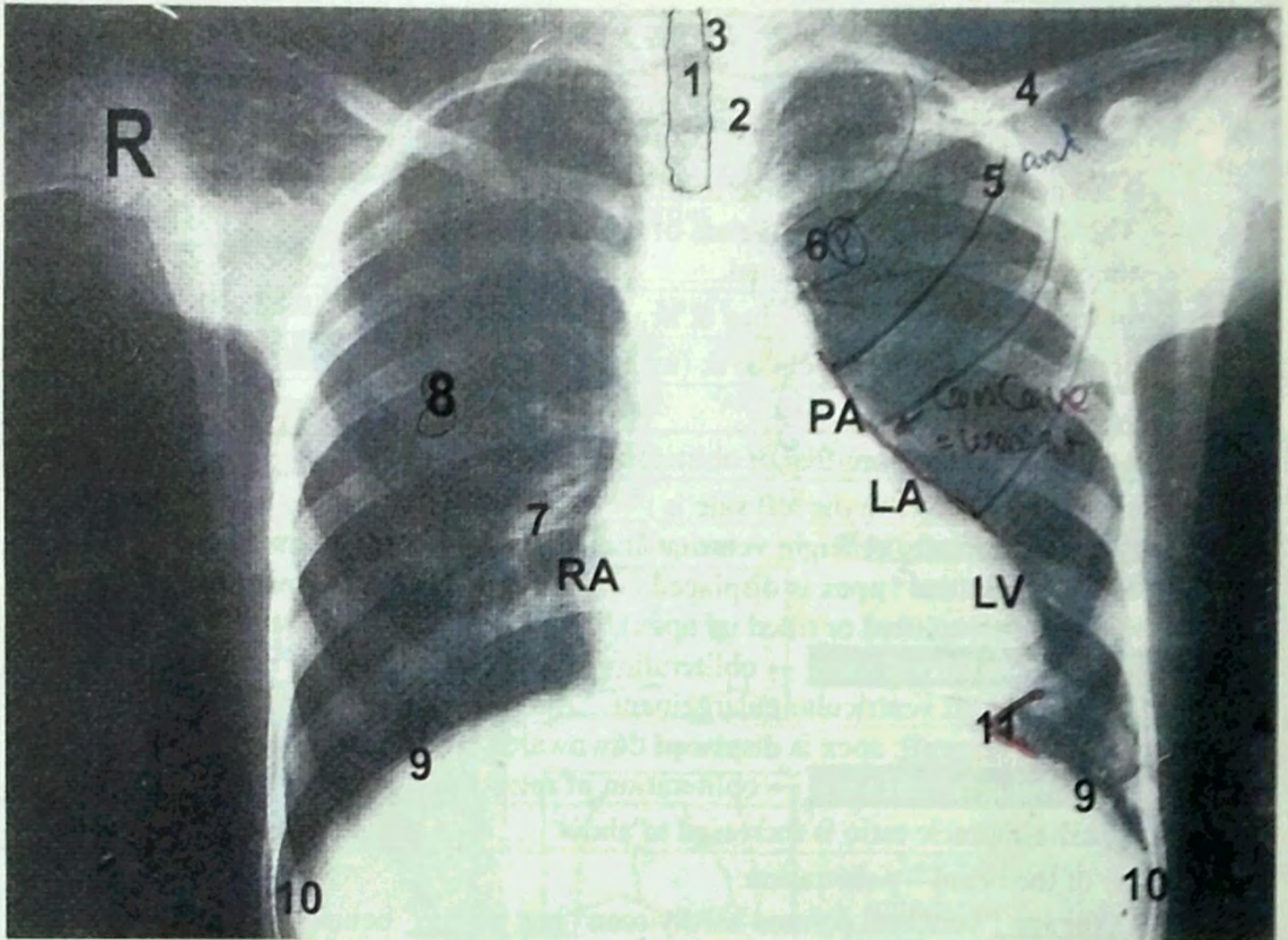
www.whiteknightlove.com

X-Rays

1. Cervical vertebrae
2. Thoracic vertebrae
3. Sacral promontory of the vertebrae
4. Ligaments
5. Anterior ribs
6. Posterior ribs
7. Brachiocephalic trunk
8. Lung fields
9. Mediastinal shadow
10. Costophrenic angles
11. Cardiac shadow
12. Diaphragm
13. Right hilum
14. Left hilum
15. Left ventricle

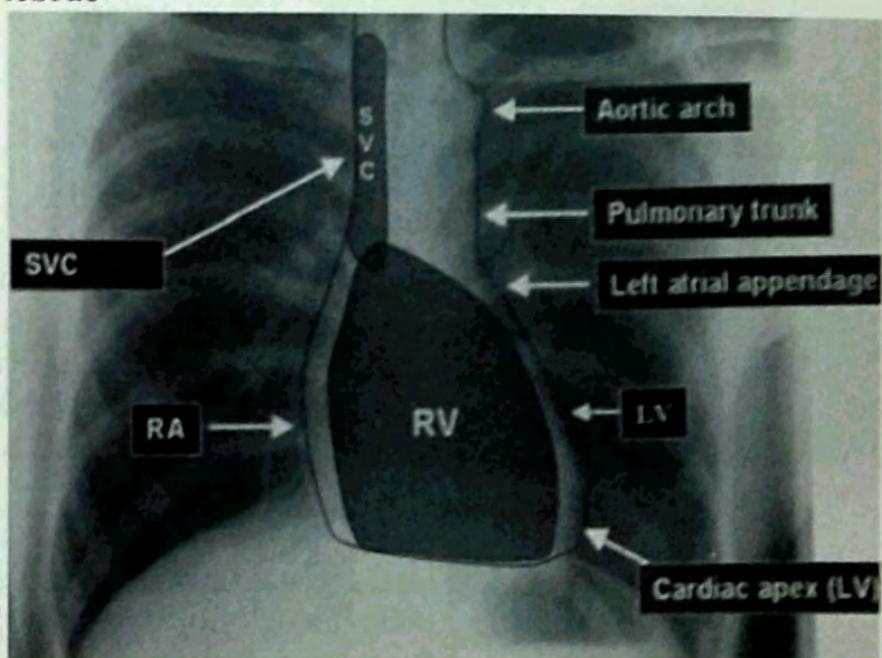
التيه يزعجون بالدموع يحدود بالابتهاج
انظروا إلى الأجيال القديمة وتأملوا. هل تترك أحد على الرب فخري؟
الذي بدأ معك اول الطريق له يترك في منتصفه
هو شافى هو عارف مش ينسى ☺

Normal heart X-ray



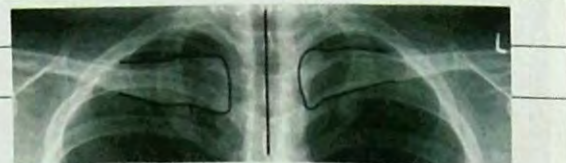
1. Tracheal air column
2. Vertebral column
3. Spinous processes of the vertebrae
4. Clavicles
5. Anterior ribs
6. Posterior ribs
7. Bronchovascular markings
8. Lung fields
9. Diaphragmatic cupulae
10. Costophrenic angles
11. Cardiophrenic angle

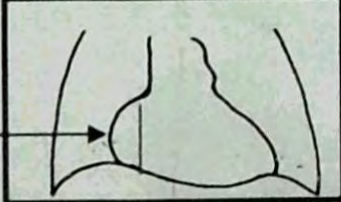
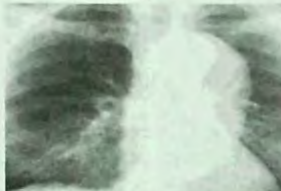
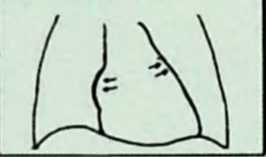
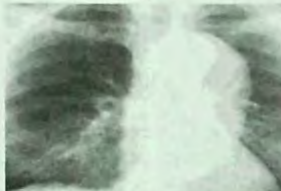
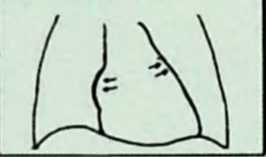
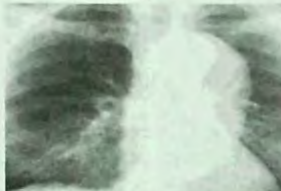
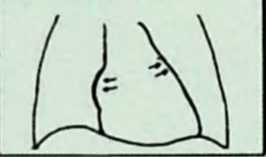
- RA : right atrium
- PA : pulmonary artery
- LA : left atrium
- LV : left ventricle

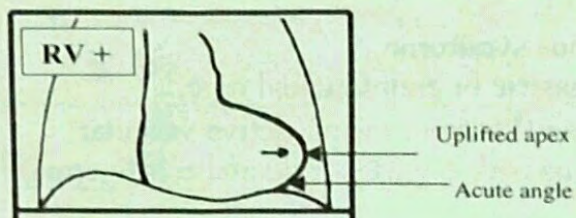


Heart – X-Ray

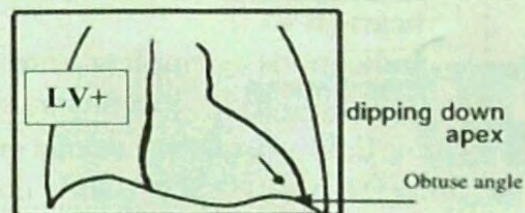
❖ How to comment on heart X-ray:

P	P lain X-ray chest & heart.	
	P osteroanterior view or lateral view	
	P atient is centralized or not	
	- Two clavicles are in the same level - The distances of the medial ends of both clavicles to midline (line passing through the vertebral spines) are equal.	
	P osition of mediastinum (trachea & heart) central or shifted.	
	P atient gender is (adult or child) & (male or female → breast shadow)	
	B ony cage is intact	
C	C ostophrenic angles are free or obliterated on both sides	
	C ardiophrenic angle in the left side is :	
	❖ Acute : normally or Right ventricular enlargement ($\pm$ cor-pulmonale)	
	- RV enlargement : apex is displaced outwards and becomes separated from the diaphragm (uplifted or tilted up apex).	
	NB : RVE on lateral view → obliteration of retro-sternal space	
	❖ Obtuse : Left ventricular enlargement	
	- LV enlargement : apex is displaced downwards & outwards. (dipping down apex)	
	NB : LVE on lateral view → obliteration of retro-cardiac space	
	❖ C ardio-thoracic ratio is increased to about % which denotes cardiomegaly.	
D	D ose of the beam = penetration:	
	• Average : vertebral column hardly seen “just visible” behind the heart • Overdose (hard X-Ray) : vertebral column <u>well seen</u> behind the heart • Under dose (soft X-Ray) : vertebral column <u>not seen</u> behind the heart	
	D iaphragm :	
	❖ Cuts the 6 th rib anteriorly , 10 th posteriorly	
	❖ Copula :	
	- Right copula is higher than left copula - Dome in shape “smooth & convex upwards” , - Not elevated, Not depressed by any diseases.	
	D etails :	
	1. Calcifications around the pericardium of the heart → constrictive pericarditis	
	- Decrease cardio-thoracic ratio - Most common cause is TB ; maybe there is evidence of TB lung as heterogeneous opacity and compensatory emphysema in the lung.	
	2. Type of valves = radiopaque rings (Edge & ball – tilting disc – bileaflets)	

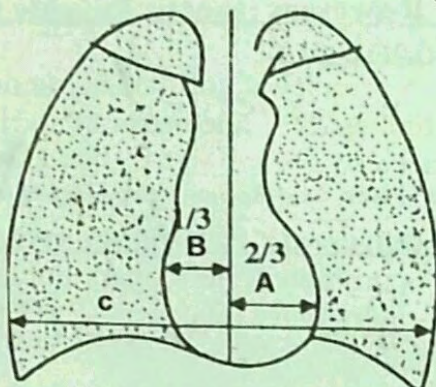
4. Pacemaker ; the battery is subcutaneous and electrodes are passing inside the heart (RV) - Indications : complete heart block & sick sinus syndrome. 5. Catheters : CVP catheter, chest tube, Nasogastric or endotracheal tube.													
L Lung field : Bronchovascular markings , increase (Plethora means active vascular congestion e.g. ASD – while congestion means passive e.g. MS) or decrease (oligemia)													
Left cardiac border & right cardiac border													
Right cardiac border - Upper part represent: SVC & ascending aorta. ➤ Bulging in the Upper part of the border : → dilated ascending aorta ❖ Causes : aortic stenosis with post-stenotic dilatation & aneurysm of ascending aorta .  - Lower part represents RA. ➤ Bulging in the Lower part of the border → right atrium enlargement ❖ Causes Tricuspid valve disease (TR) & mitral valve disease) 	Left cardiac border <table border="1"> <tr> <td data-bbox="593 470 920 728"> 1st space  </td><td data-bbox="920 470 1464 728"> Represent : Aortic knuckle = Aortic arch → prominent aortic knuckle in the first space = aneurysm of aortic arch Presents as wide superior mediastinum </td></tr> <tr> <td data-bbox="593 728 920 952"> 2nd space  </td><td data-bbox="920 728 1464 952"> Represent : Pulmonary artery → prominent pulmonary conus → = pulmonary dilatation (P.HTN) </td></tr> <tr> <td data-bbox="593 952 920 1467"> 3rd space  </td><td data-bbox="920 952 1464 1467"> Represent : Left atrium Left atrium enlargement evidence by : → شمال : obliteration of the waist = mitralization (Mitral valve disease most probably MS) → يمين : double contour of the RT cardiac border ❖ On lateral view with barium swallow LA enlargement = - Backward displacement (± indentation) of the esophagus. </td></tr> <tr> <td colspan="2" data-bbox="593 1467 1464 1579"> • Waist of the heart is a concavity on the left cardiac border opposite 2nd and 3rd space (formed by normal contour of the pulmonary artery and left auricle. </td></tr> <tr> <td data-bbox="593 1579 920 1825"> 3rd rib </td><td data-bbox="920 1579 1464 1825"> Normally aorta folded upon itself, Abnormally : unfolding of aorta in front 3rd rib = dilated aorta - Systemic HTN - Atherosclerosis - Old age </td></tr> <tr> <td data-bbox="593 1825 920 1915"> Angle = Apex </td><td data-bbox="920 1825 1464 1915"> Cardiophrenic angle in the left side ; see before </td></tr> </table>	1st space 	Represent : Aortic knuckle = Aortic arch → prominent aortic knuckle in the first space = aneurysm of aortic arch Presents as wide superior mediastinum	2nd space 	Represent : Pulmonary artery → prominent pulmonary conus → = pulmonary dilatation (P.HTN)	3rd space 	Represent : Left atrium Left atrium enlargement evidence by : → شمال : obliteration of the waist = mitralization (Mitral valve disease most probably MS) → يمين : double contour of the RT cardiac border ❖ On lateral view with barium swallow LA enlargement = - Backward displacement (± indentation) of the esophagus.	• Waist of the heart is a concavity on the left cardiac border opposite 2nd and 3rd space (formed by normal contour of the pulmonary artery and left auricle.		3rd rib	Normally aorta folded upon itself, Abnormally : unfolding of aorta in front 3rd rib = dilated aorta - Systemic HTN - Atherosclerosis - Old age	Angle = Apex	Cardiophrenic angle in the left side ; see before
1st space 	Represent : Aortic knuckle = Aortic arch → prominent aortic knuckle in the first space = aneurysm of aortic arch Presents as wide superior mediastinum												
2nd space 	Represent : Pulmonary artery → prominent pulmonary conus → = pulmonary dilatation (P.HTN)												
3rd space 	Represent : Left atrium Left atrium enlargement evidence by : → شمال : obliteration of the waist = mitralization (Mitral valve disease most probably MS) → يمين : double contour of the RT cardiac border ❖ On lateral view with barium swallow LA enlargement = - Backward displacement (± indentation) of the esophagus.												
• Waist of the heart is a concavity on the left cardiac border opposite 2nd and 3rd space (formed by normal contour of the pulmonary artery and left auricle.													
3rd rib	Normally aorta folded upon itself, Abnormally : unfolding of aorta in front 3rd rib = dilated aorta - Systemic HTN - Atherosclerosis - Old age												
Angle = Apex	Cardiophrenic angle in the left side ; see before												
Gross cardiomegaly : asymmetrical enlargement , borders not well defined , increase bronchovascular markings = without characteristic shape													
Diagnosis : Gross cardiomegaly “cor bovinum” due to enlargement of ...&... for differential diagnosis , most probably due to ...													



❖ Apex:

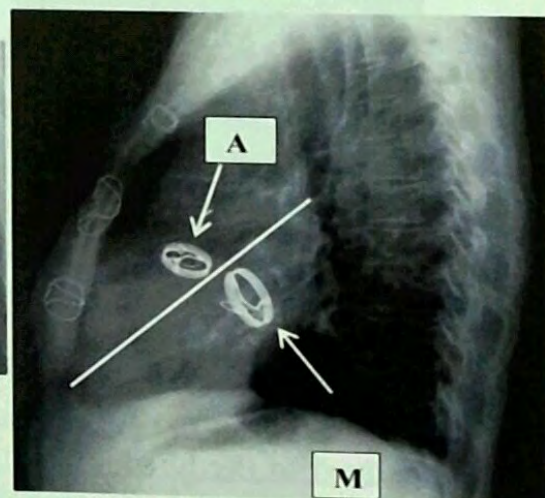
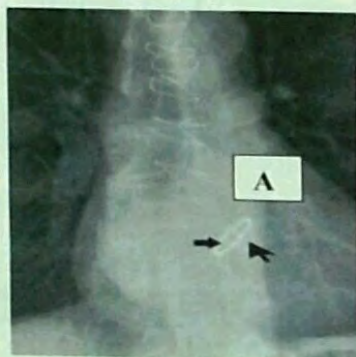


❖ Cardiothoracic ratio:



- A : point from midline to maximum point in the left cardiac border, normally = 2/3 of the heart
- B: point from midline to maximum point in the right cardiac border, normally = 1/3 of the heart
- A+B = maximum width of the cardiac shadow
- C = the maximum chest width
- Normally : $(A+B) \div C = < \frac{1}{2}$
- if the ratio is more than 1/2 = cardiomegaly

Valves:



❖ Signs of LA enlargement :

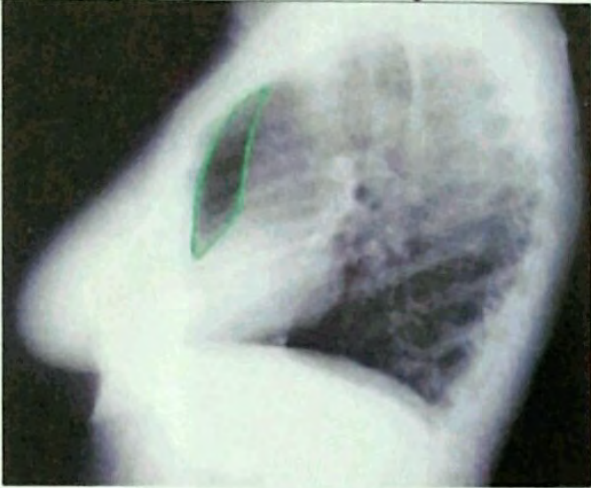
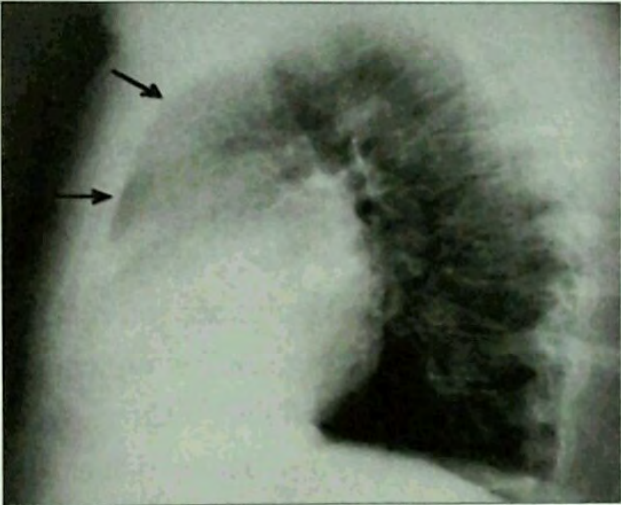
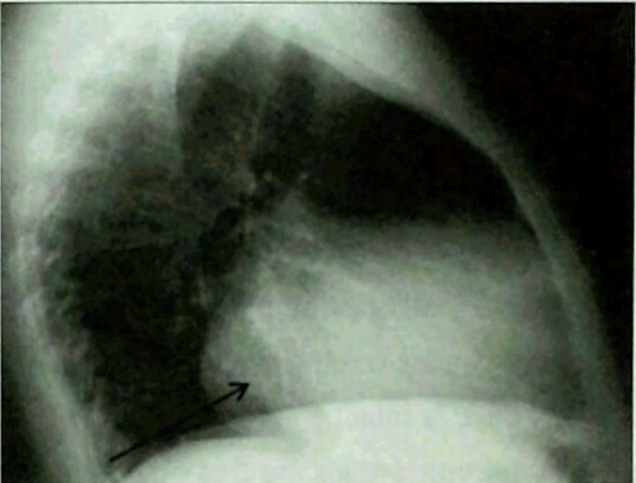
- ❖ Double contour of the RT cardiac border & mitralization



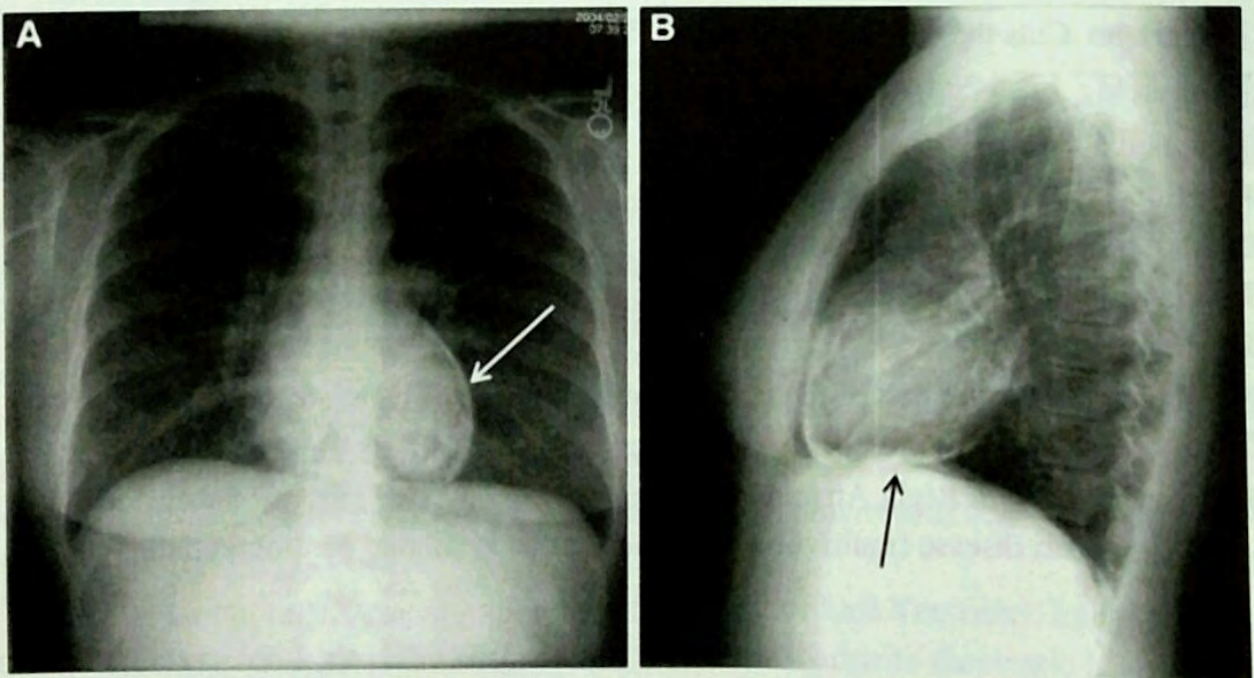
Backward displacement ($\pm$ indentation) of the esophagus. (lateral view)



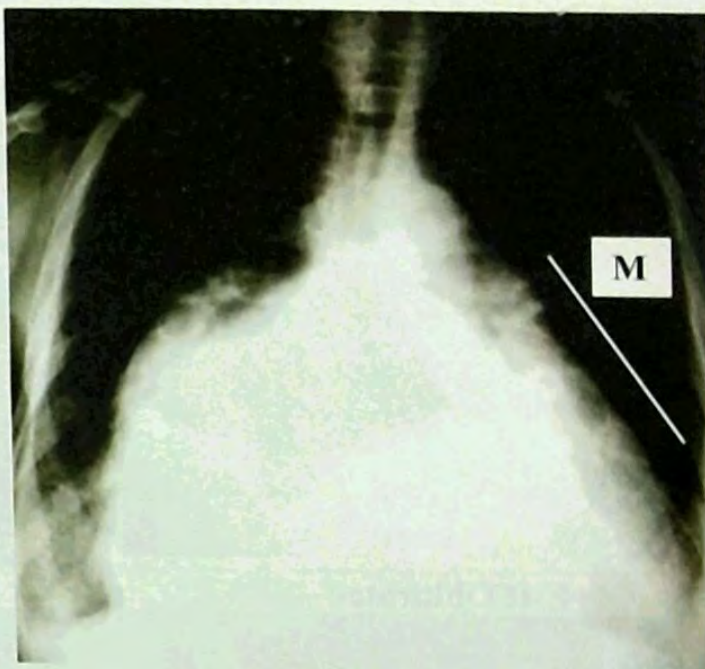
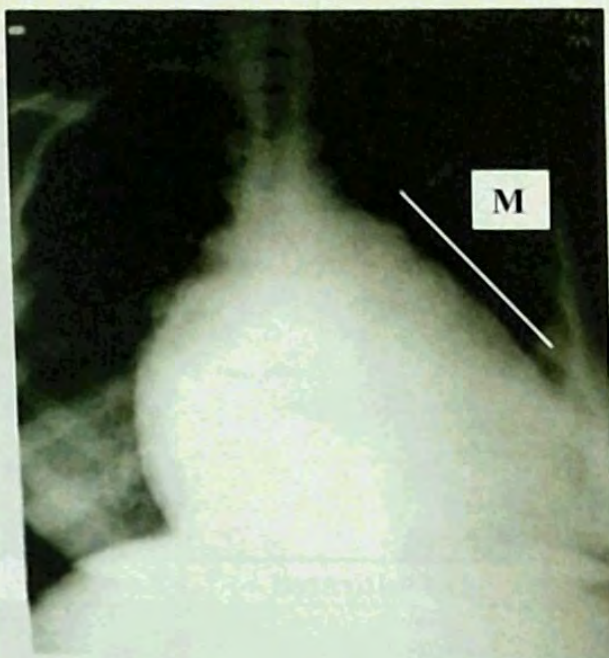
❖ Spaces on the lateral view :

Retrosternal space	Retrocardiac space
	
❖ If Obliterated → RVE	If Obliterated → LVE
	

❖ Constrictive pericarditis



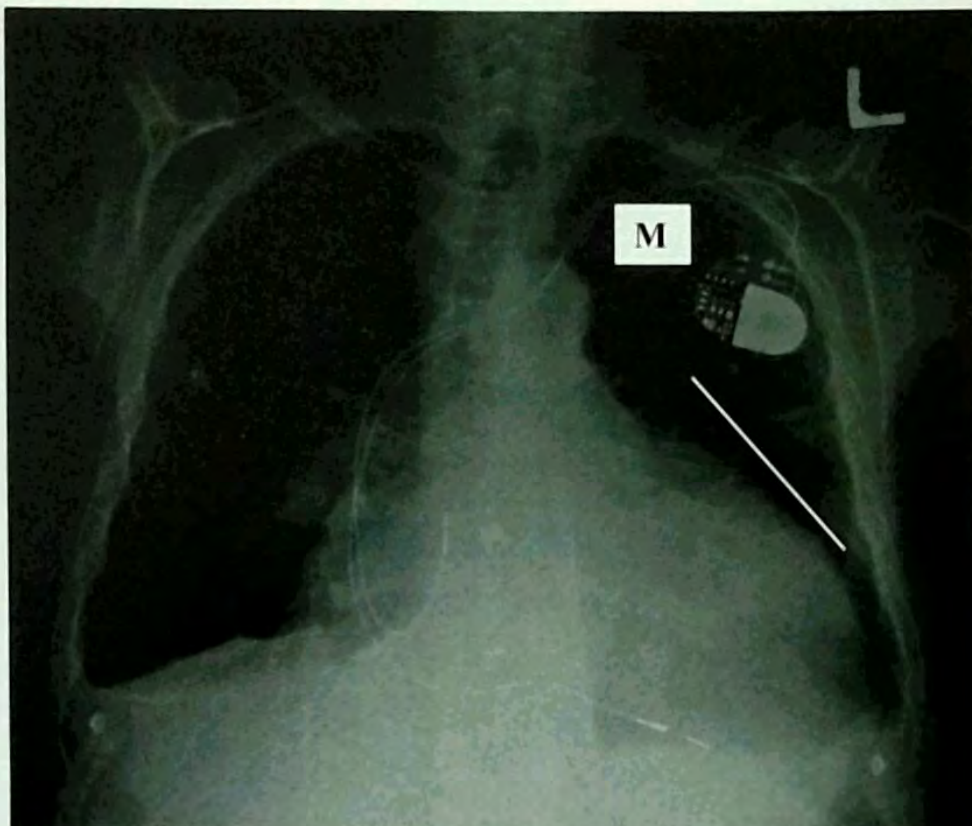
Cardiomegaly WITHOUT characteristic shape



M

• MITRALIZED HEART : LA +

- Plain X-ray chest & heart.
- Posteroanterior view
- Patient is not centralized
- Position of mediastinum (trachea & heart) is central
- Patient gender is adult female (breast shadow)
- Bony cage is intact
- Costophrenic angles are free on both sides
- Cardiophrenic angle in the left side is obtuse → LV enlargement
- Cardio-thoracic ratio is increased to about 70 % which denotes cardiomegaly.
- Diaphragm : Cuts the 6th rib anteriorly , 10th posteriorly
- Lung field : bilateral increase in Bronchovascular markings
- Left cardiac border :
 - Prominent pulmonary conus → pulmonary dilatation (P.HTN)
 - Obliteration of the waist = mitralization → LA enlargement
 - Bulging left cardiac border with dipping down & shifted downwards & outwards apex → LV enlargement
- Bulging in the Lower part of the right cardiac border → right atrium enlargement
- ❖ **Diagnosis : Gross cardiomegaly** : due to enlargement of Left Ventricle , Left Atrium , Pulmonary artery & Right Atrium for differential diagnosis , most probably due to rheumatic heart disease (multivulvar disease) or due to dilated cardiomyopathy



- **P**lain X-ray chest & heart.
- **P**osteroanterior view
- **P**atient is not centralized
- **P**osition of mediastinum (trachea & heart) is central
- **P**atient gender is adult male
- **B**ony cage is intact
- **C**ostophrenic angle is free on the right side , while in the left side is obliterated by homogeneous opacity with fluid level (concave upwards) rising lateral to axilla → mild pleural effusion.
- **C**ardiophrenic angle in the left side is obtuse → LV enlargement
- **C**ardio-thoracic ratio is increased to about 70 % which denotes cardiomegaly.
- **D**iaphragm :Cuts the 10th rib posteriorly
- **D**etails : Pacemaker ; the battery is subcutaneous and electrodes are passing inside the heart (RV)
- **L**ung field : bilateral increase in Bronchovascular markings
- **L**eft cardiac border :
 - Prominent pulmonary conus → pulmonary dilatation (P.HTN)
 - Obliteration of the waist = mitralization → LA enlargement
 - Bulging left cardiac border with dipping down & shifted downwards &outwards apex → LV enlargement
- ❖ **Diagnosis : Gross cardiomegaly** : due to enlargement of Left Ventricle , Left Atrium & Pulmonary artery for differential diagnosis , most probably due to rheumatic heart disease (multivalvular disease) or due to dilated cardiomyopathy



• **GLOBULAR HEART:**
RA + , RV + & broad and wide cardiac base

- **P**lain X-ray chest & heart.
 - **P**osteroanterior view
 - **P**atient is not centralized
 - **P**osition of mediastinum (trachea & heart) is central
 - **P**atient gender is child (broadened spatulate ribs).
 - **B**ony cage is intact
 - **B**road & wide cardiac base. (NB: TGA has narrow base)
 - **C**ostophrenic angles are free on both sides
 - **C**ardiophrenic angle in the left side is acute → RV enlargement
 - **C**ardio-thoracic ratio is increased to about 70 % which denotes cardiomegaly.
 - **L**ung field : mild increase in Bronchovascular markings
 - **L**eft cardiac border : bulging left cardiac border with uplifted & shifted outwards apex → RV enlargement
 - Bulging in the **L**ower part of the **right cardiac border** → right atrium enlargement
- ❖ **Diagnosis : Gross cardiomegaly** : due to enlargement of right Ventricle & right Atrium for differential diagnosis , most probably due to metabolic diseases.



- **P**lain X-ray chest & heart.
- **P**osteroanterior view
- **P**atient is centralized
- **P**osition of mediastinum (trachea & heart) is central
- **P**atient gender is adult male
- **B**ony cage is intact
- **C**ostophrenic angles are free on both sides
- **C**ardiophrenic angle in the left side is acute → RV enlargement
- **C**ardio-thoracic ratio is increased to about 60 % which denotes cardiomegaly.
- **D**iaphragm :Cuts the 10th rib posteriorly
- **L**ung field :
 - Bilateral increase in Bronchovascular markings
 - Heterogenous opacity in the left upper lobe of the lung → Pneumonia
- **L**eft cardiac border :
 - Prominent pulmonary conus → pulmonary dilatation (P.HTN)
 - Obliteration of the waist = mitralization → LA enlargement
 - Bulging of left cardiac border with uplifted & shifted outwards apex → RV enlargement
- Double contour of the right cardiac border → LA enlargement
- ❖ **Diagnosis : Gross cardiomegaly** : due to enlargement of Right Ventricle , Left Atrium & Pulmonary artery for differential diagnosis , most probably due to rheumatic heart disease (multivulvar disease) or due to dilated cardiomyopathy

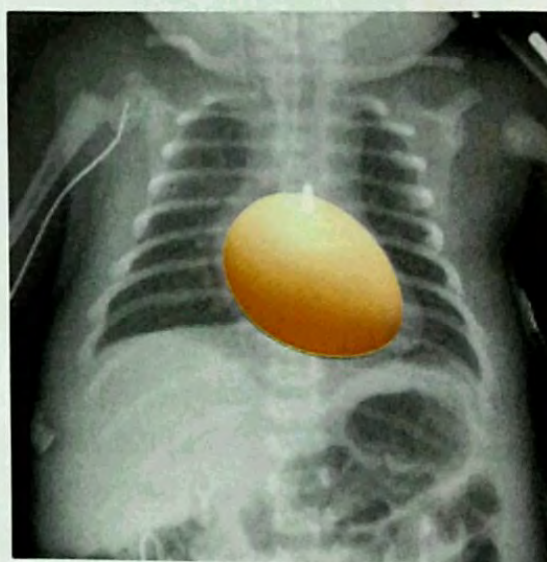
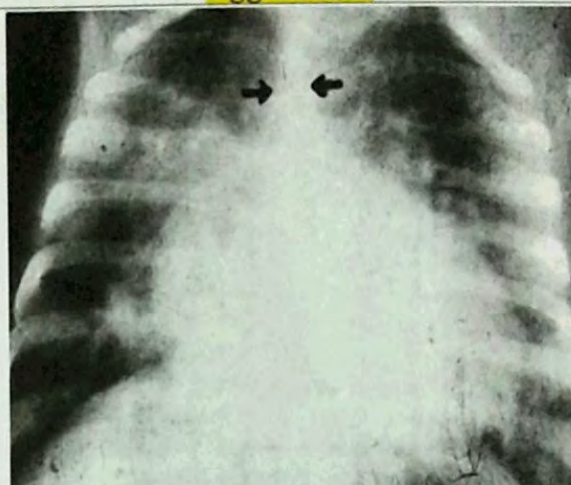
Cardiomegaly WITH characteristic shape



Flask shaped heart



Egg on side



- Wide & broad cardiac base - Stenciled (very well defined) , smooth & symmetrical bulging of cardiac borders - Cardiophrenic angle on the left side is acute - Lung oligemia : decrease bronchovascular markings - Radiological appearance of the heart simulates a flask - If complicated pneumopericardium (area of jet black translucency surrounding the cardiac shadow)	- Narrow cardiac base - Marked bulge of the right cardiac border (RA dilatation) - Cardiophrenic angle on the left side is acute (RV dilatation) - Lung plethora , Increase bronchovascular markings - Radiological appearance of the heart simulates egg on side
➤ Diagnosis : cardiomegaly for DD most probably due to pericardial effusion	➤ Diagnosis : cardiomegaly for DD most probably due to transposition of great arteries

Boot shaped heart "Aortic configuration"



- Plethoric lungs
 - Wide mediastinum
 - Dilated aorta
 - Preserved or exaggerated waist
 - Cardio-thoracic ratio is increased to about % which denotes cardiomegaly.
 - Enlarged LV; obtuse cardiophrenic angle with dipping down apex
 - Radiological appearance of the heart simulates a boot.
- **Diagnosis :** cardiomegaly for DD, causes :
- Coarctation of aorta with Rosler's sign (notches in the lower parts of ribs due to dilated intercostal vessels)
 - Advanced systemic HTN , so it is called hypertensive heart disease
 - Aortic regurge

Coeur en sabot in Fallot's tetralogy

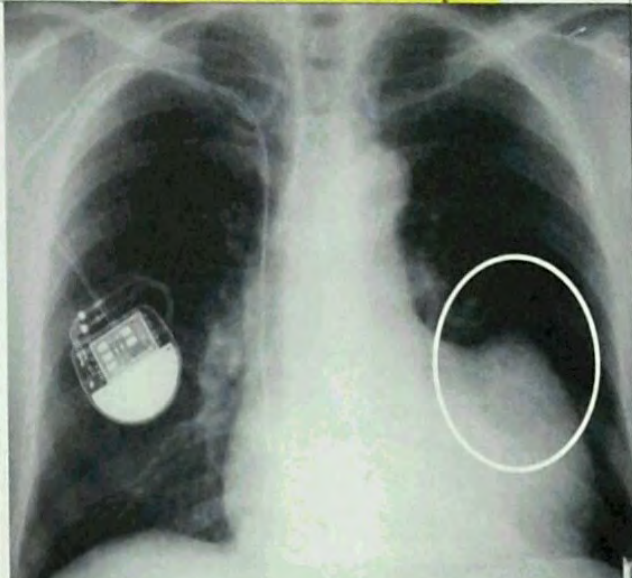


- Oligoemic lungs
 - Wide mediastinum
 - Dilated aorta
 - Exaggerated waist
 - Mild increase in Cardiothoracic ratio
 - Mild RV enlargement; acute cardiophrenic angle with tilted up apex
 - Radiological appearance of the heart simulates a wooden shoes with elevated tip.
- **Diagnosis :** Fallot's tetralogy :
- Pulmonary stenosis
 - Overriding aorta
 - VSD
 - Mild RV enlargement.

Right ventricular enlargement

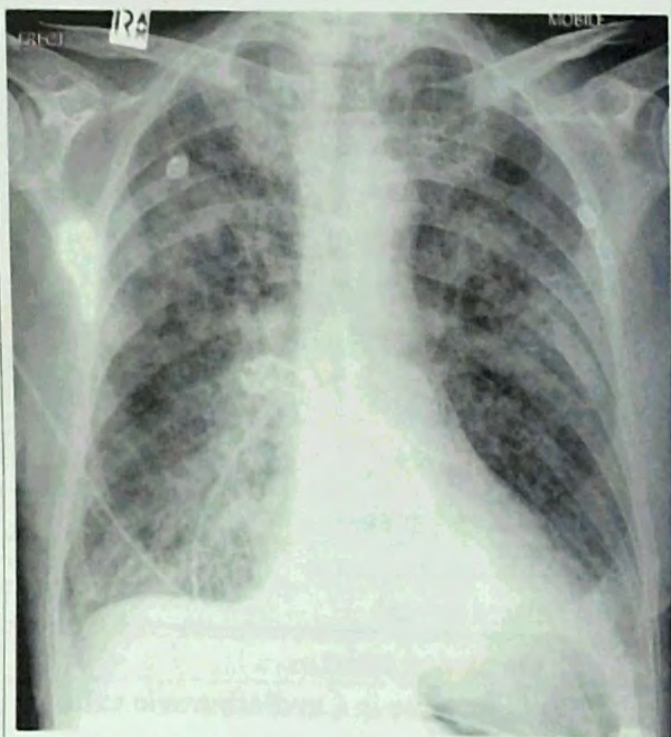


Left ventricular aneurysm

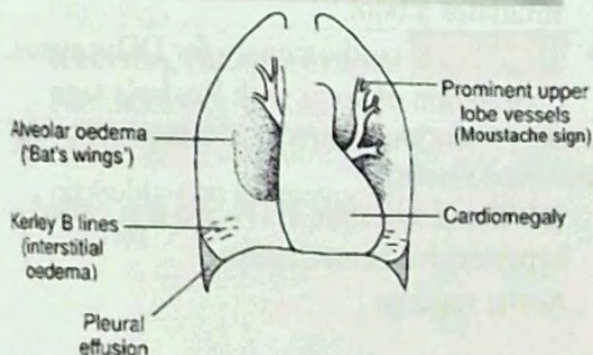


Increase cardiothoracic ratio with shouldering (shelving) of the left cardiac border.

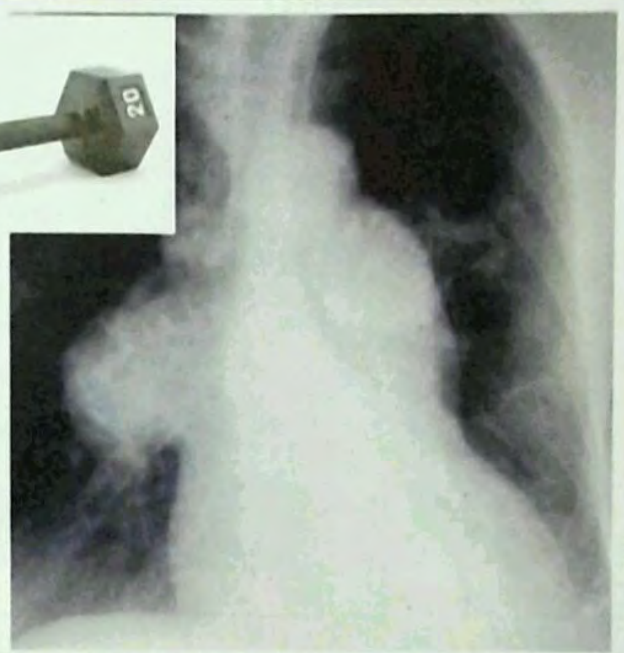
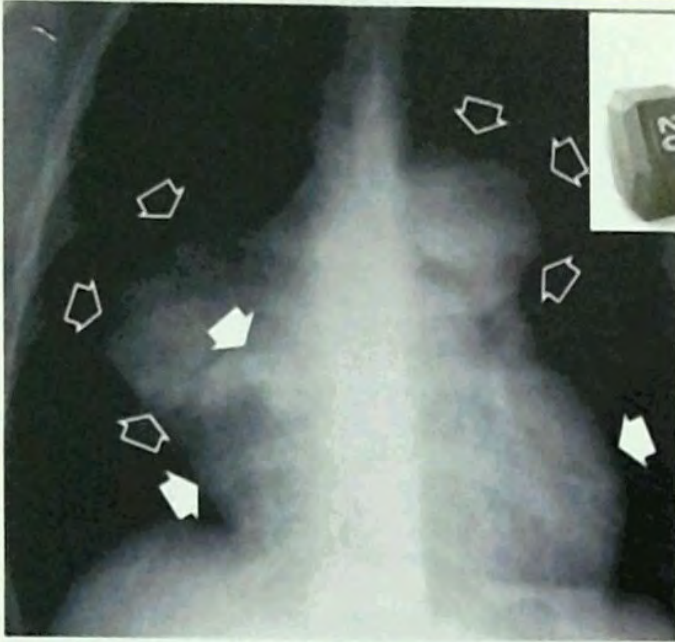
Acute pulmonary edema



- **Haziness of lung fields**
- **Moustache sign** : pulmonary congestion : exaggerated pulmonary vascular markings especially in upper lung zones (prominent upper lobe vessels)
- **Kerley B lines** :
- interstitial edema , basal , thin , short lines
- **± Bat's wing** : alveolar edema
- **± Cardiomegaly**
- **Pleural effusion.**



Dumbbell shaped heart



- **Aneurysmal dilatation** of right and left pulmonary arteries as in primary pulmonary hypertension or bilharzial cor-pulmonale
- **Lung oligemia**
- **Radiological appearance** of the heart simulates a dumbbell.

Dextrocardia : situs inversus totalis



- **Heart on right side** of thorax mainly and apex pointing to the right .
- **Right cardiac border** is composed of pulmonary artery , left atrium & left ventricle
- **Left cardiac border** is composed of right atrium

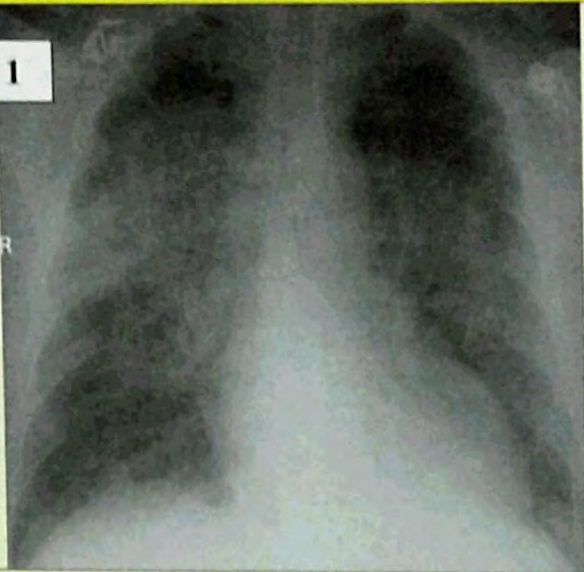
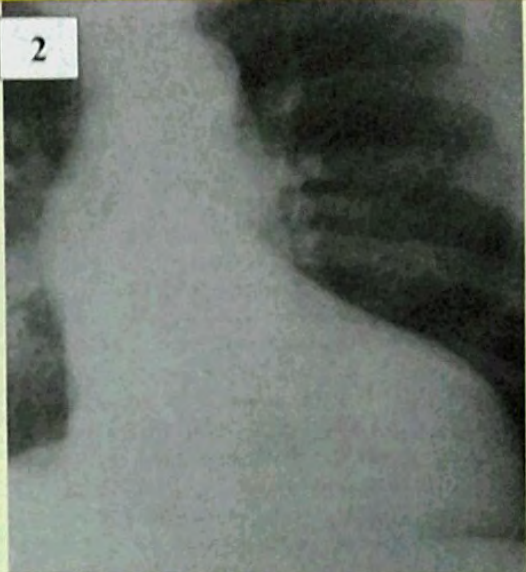
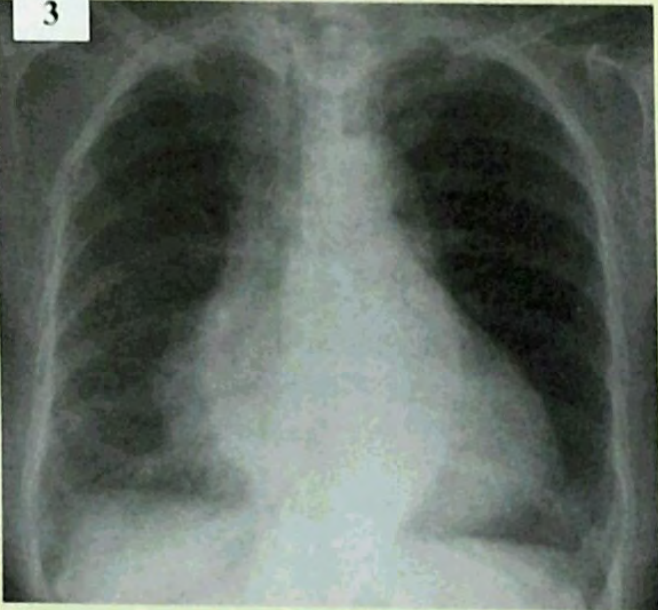
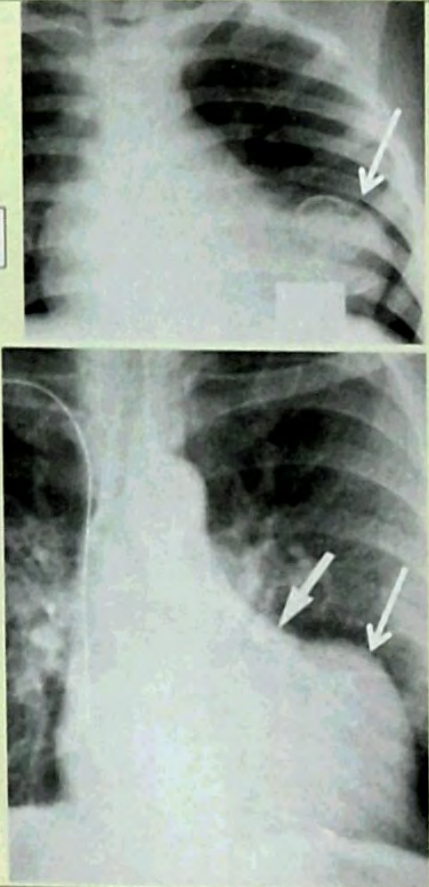
- **Abdominal viscera** : gastric air bubble on the right side & liver shadow on the left side.

Dextrocardia : isolated



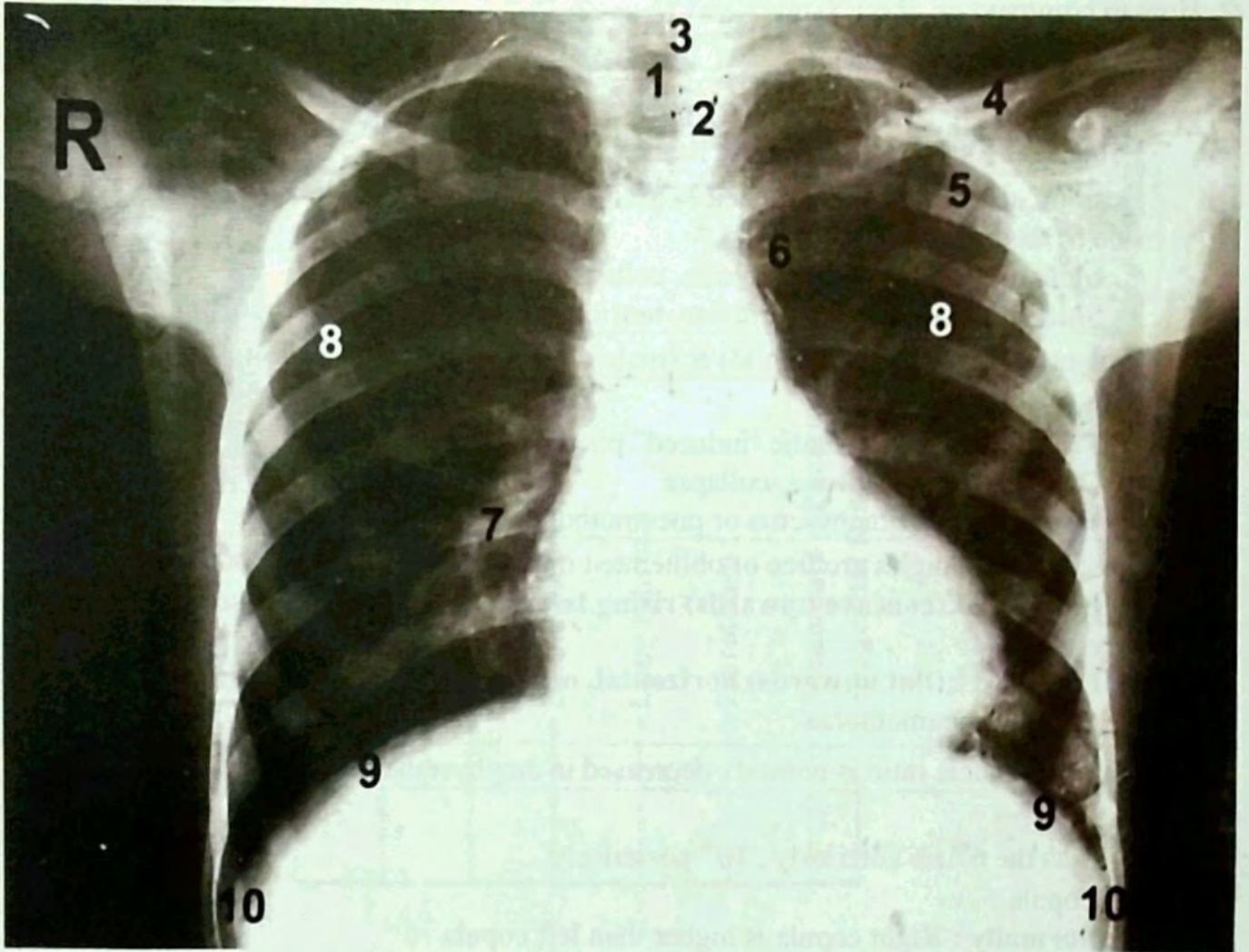
- **Abdominal viscera** : in normal position , gastric air bubble on the left side & liver shadow on the right side.

- **NB: Dextroposition** : cardiac displacement due to lung pathology.

Pre-test	
1 	2 
• Diagnosis :	•
3 	4 
• Diagnosis :	•

Answers
1) Acute pulmonary edema
2) Boot shaped heart: aortic configuration
3) Gross cardiomegaly for differential diagnosis due to rheumatic heart disease or due to dilated cardiomyopathy
4) Left ventricular aneurysm

Normal Chest – X-Ray



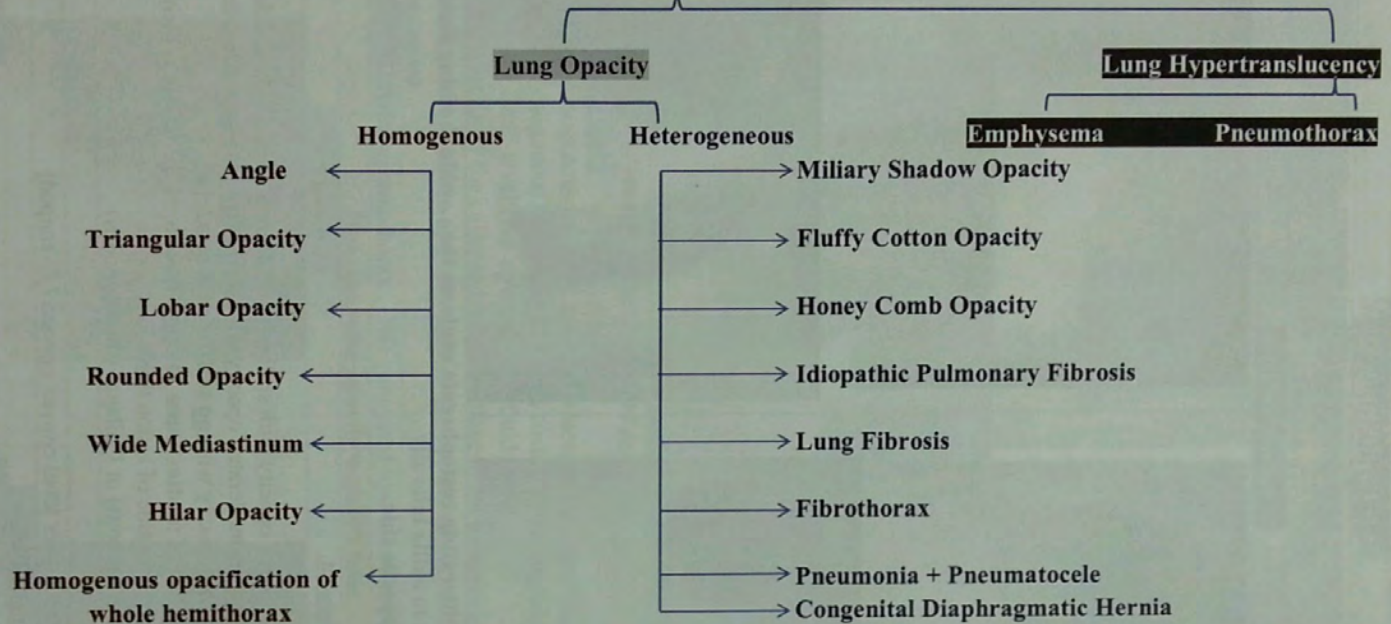
1. Tracheal air column
2. Vertebral column
3. Spinous processes of vertebrae
4. Clavicles
5. Anterior ribs
6. Posterior ribs
7. Bronchovascular markings
8. Lung fields
9. Diaphragmatic cupulae
10. Costophrenic angles

Chest – X-Ray

❖ How to comment on chest X-ray:

P	P lain X-ray chest & heart.
	P osteroanterior view or lateral view
	P atient is centralized or not : see heart X-ray
	P osition of mediastinum (trachea & heart) central or shifted to ... side which is ... side of the lesion. - Shift to the same side : fibrosis, collapse - Shift to opposite side : effusion, tension pneumothorax , hydropneumothorax.
	P atient gender is (adult or child) & (male or female→ breast shadow)
	B ony cage = ribs : - Fractured rib: traumatic ‘induced” pneumothorax - Crowded ribs : fibrosis, collapse - Wide spaces : emphysema or pneumothorax
C	C ostophrenic angles are free or obliterated on side by homogenous opacity with: - Fluid level;(concave upwards) rising laterally to axilla→ in case of pleural effusion - Fluid level;(flat upwards) horizontal, occupying the hemithorax → in case of hydropneumothorax
	C ardio-thoracic ratio is normal , decreased in emphysema or can't be assessed
D	D iaphragm : • Cuts the 6th rib anteriorly , 10th posteriorly • Copula : - Normally : Right copula is higher than left copula - Normally : Dome in shape “smooth & convex upwards ” , - Abnormally : Elevated (tenting) by fibrosis or collapse, or depressed by emphysema , pneumothorax or hydropneumothorax.
	D etails : * Catheters : CVP catheter, chest tube, Nasogastric or endotracheal tube.
L	L ung field : Bronchovascular markings , - Increase in emphysema - Decrease or absent in pneumothorax
S	S ite : - Lobes: • Right lung : superior lobe , middle lobe & inferior lobe • Left lung : superior lobe & inferior lobe . - Laterality: Unilateral : Right or left side, or Bilateral . - Zones : upper(1,2 space) , middle (3,4), lower (5,6)
	S ize : small , large or 3x 3 cm ... etc.
	S hape : rounded , triangular, fluffy cotton , ... etc.
	S hadow : homogenous or heterogenous opacity
	S everity : mild , moderate , massive (all hemoithorax)

LUNG LESIONS



❖ Lung opacity

I- Homogenous :

A-Angle :

1- Pleural effusion



❖ Homogenous opacity obliterating costophrenic angle on the ... side & rising fluid level (concave upwards) to axilla laterally

❖ ± Mediastinal shift to opposite side.

• **NB :**

- Intercostal tube may be present.
- Amount according to fluid level :
 - 2nd rib : **massive effusion**; large opacity with shift of apex & trachea to opposite side
 - 2nd → 4th : **moderate effusion**; moderated opacity with shift of **apex** to opposite side
 - 4th rib : **mild effusion** ; small opacity with **no** shift of apex or trachea
- Pleural effusion causing **shift of mediastinum to opposite side** of the lesion, if there is shift of mediastinum to the same side of lesion think in :
 - Underlying fibrosis (heterogenous) or Collapse (homogenous)

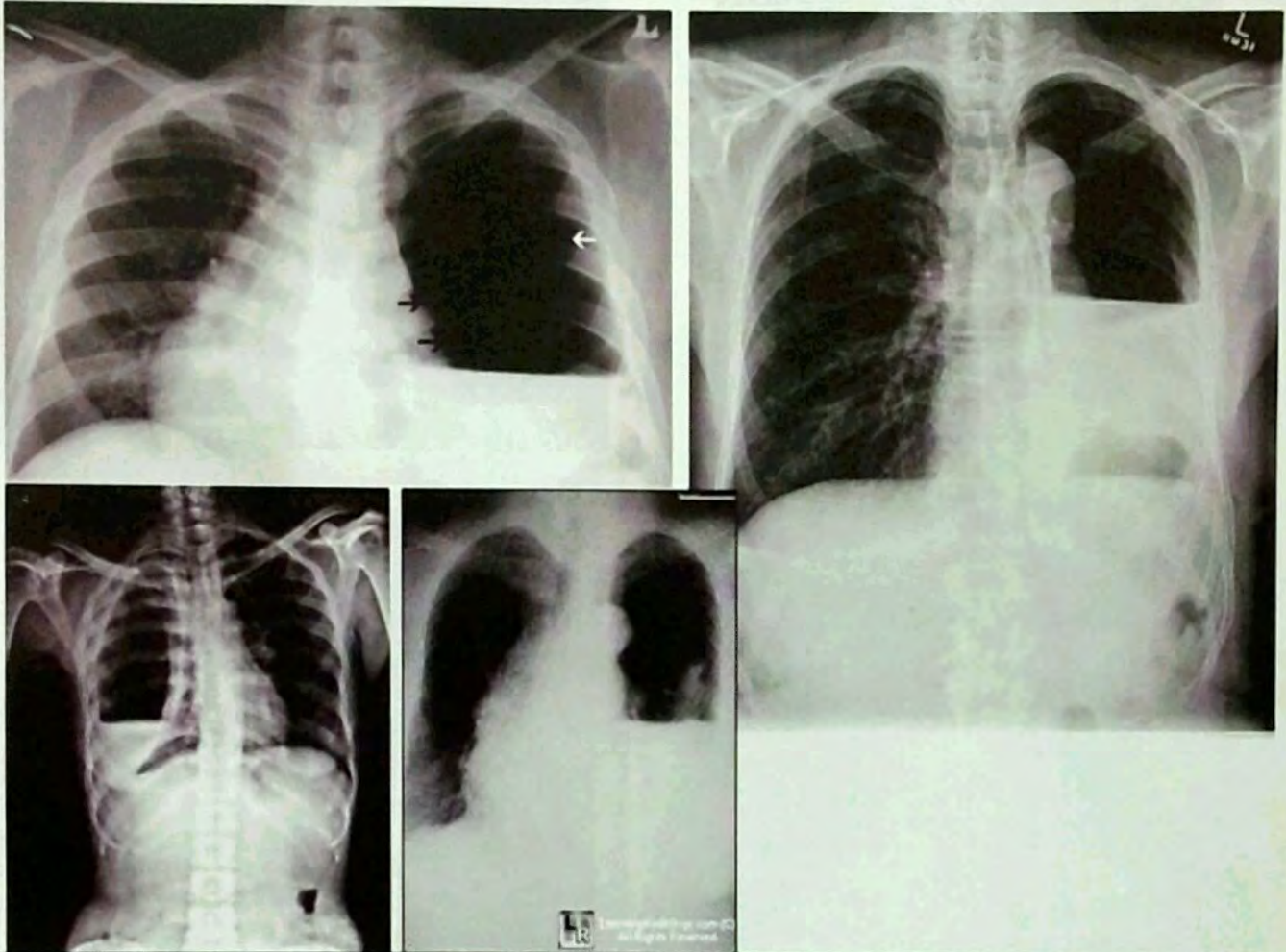
Diagnosis : Pleural effusion

NB : encysted pleural effusion : upper level convex upward (D-shaped)

• **Causes of bilateral pleural effusion :**

- Generalized anasarca, Systemic diseases (RA, SLE) & bilateral lung diseases.

2- Hydropneumothorax



- ❖ There is **line of pleura** forming the lung edge:
 - **Outside this line :**
 - **Above :** homogenous jet black hypertranslucency devoid of lung markings
 - **Below :** homogenous opacity obliterating costophrenic angle on the ... side & has horizontal Fluid level;(flat upwards) (air fluid level)
 - **Inside this line :** the collapsed lung lies close to the mediastinum.
- ❖ ± **Mediastinal shift to opposite side & the cupula of diaphragm may be flattened or depressed**

Diagnosis : Hydropneumothorax , (NB : encysted hydropneumothorax)

B- Triangular opacity with it's base ... :

• Peripheral :



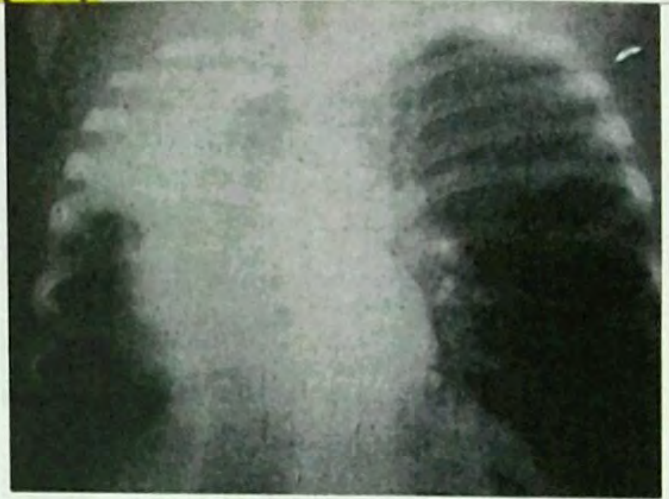
Diagnosis : Pulmonary infarction

• Inwards :



Diagnosis : Pneumonic patch

C- Lobar opacity



Homogenous opacity of the (e.g. right upper) lobe with ...

Central mediastinum

Shifted mediastinum to the same side of the lesion which is ... side

Normal sized lobe

Triangular concave sharp lower border of shrunken lobe

Normal spaced ribs & diaphragm

Crowded ribs & elevated (tenting) diaphragm if the lesion in lower lung zones

Diagnosis : lobar consolidation (pneumonia) ± lung abscess.

Diagnosis : lobar collapse

D- Rounded opacity :

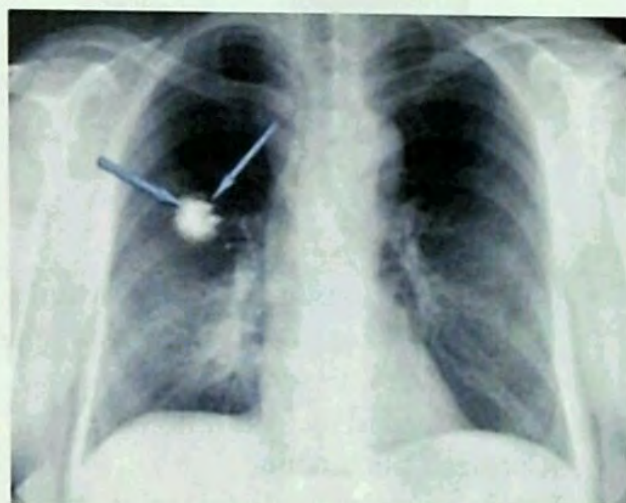
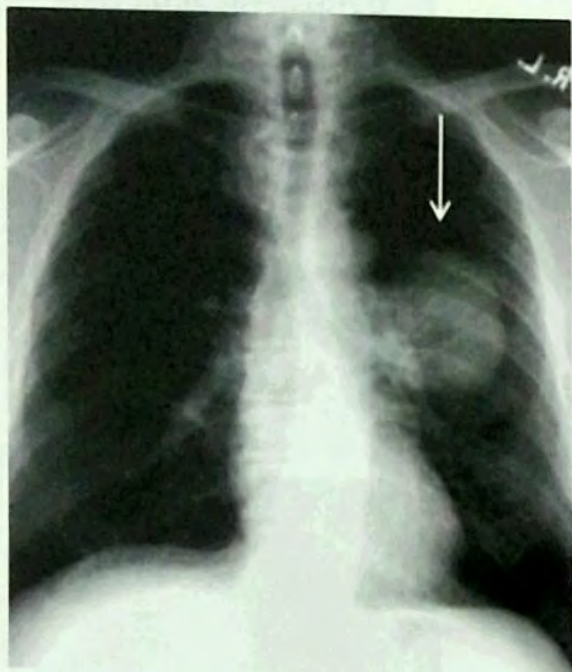
- **Apical shadow :** Homogenous, circular, well circumscribed opacity in ... side upper lung zone.

• **Diagnosis :**

- ❖ Apical shadow for DD:
 - Apical TB fibrosis
 - Pancoast tumor
 - Klebsiella pneumonia
 - Pleural thickening



• **Coin shadow = pulmonary nodule:**



Single unilateral

• **Cannon balls:**



Multiple bilateral

Homogenous, circular, well circumscribed (or ill-defined) opacity in ... side ... lung zone .

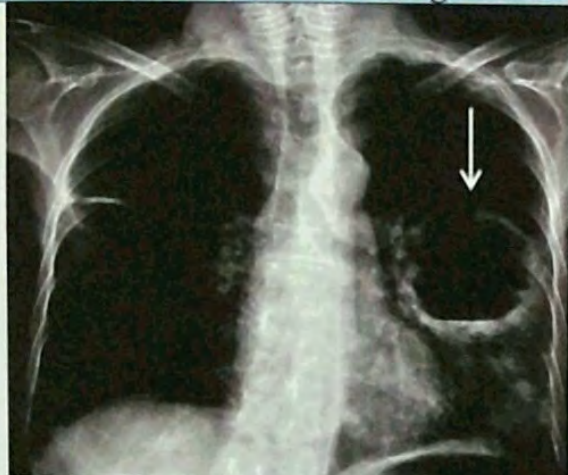
NB: If outer Peripheral opacity : rise the suspicious of chest wall lesion or methothelioma

➤ **Diagnosis :** (Coin shadow or Cannon balls) for DD :

- TB (tuberculoma)
- Tumor :
 - Benign : bronchial adenoma
 - Primary malignant : bronchogenic carcinoma
 - Secondary : single metastasis e.g. hypernephroma
- Lung cyst (hydatid)
- Pneumonic patch

• **Cavity = ring opacity :**

▪ **With air fluid level = Lung abscess**



▪ **Without air fluid level**



Acute

Irregular thin wall surrounded with consolidation

Chronic

Regular thick wall, no consolidation, usually with pulmonary fibrosis

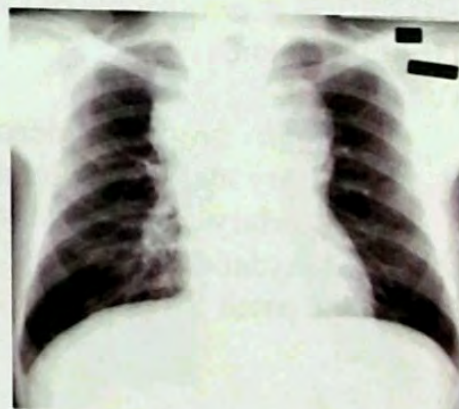
➤ **Diagnosis :** The ... side ... lung zone show homogeneous ring opacity, ... x ... cm with ... wall and the cavity showing air fluid level suggesting of ... lung abscess

➤ **Diagnosis :** Homogenous ring opacity in ... side ... lung zone with ... (regular or irregular) wall for DD :

- TB surrounded by infiltration
- Klebsiella pneumonia
- Emphysematous bulla (associated with emphysema)
- Cyst : congenital, hydatid, retention cyst

E- Wide mediastinum : Broad superior mediastinum for DD:

- Aortic aneurysm, Bilateral Lymphadenopathy, Dermoid cyst, Thymoma or Retrosternal goiter.



F- Hilar opacity (mediastinal) :

• Unilateral :



- **Diagnosis :** Unilateral Hilar opacity for DD:
- Bronchogenic carcinoma
 - Ghon's focus
 - LN (if lobulated "festooned" rise the suspicious to malignant LN)

• Bilateral :

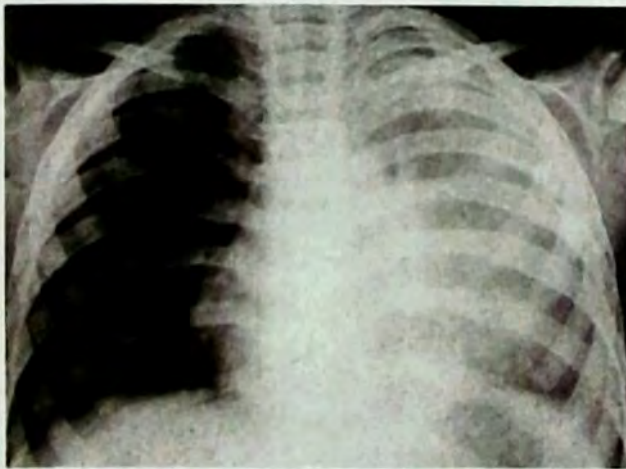


- **Diagnosis :** Bilateral Hilar opacity for DD:
- **Infections :**
 - TB
 - Viral : infectious mononucleosis
 - Fungal : histoplasmosis
 - **Neoplastic :**
 - Bronchogenic carcinoma
 - Lymphomas , lymphatic leukemia
 - **Sarcoidosis**
 - **Inhalational :** silicosis

G- Homogenous opacification of (... side) hemithorax (whole lung):

• Central mediastinum

- **Either** Pleural effusion with underlying collapse (or fibrosis) ولكن بتعادل
- **Or** Total lung pneumonia

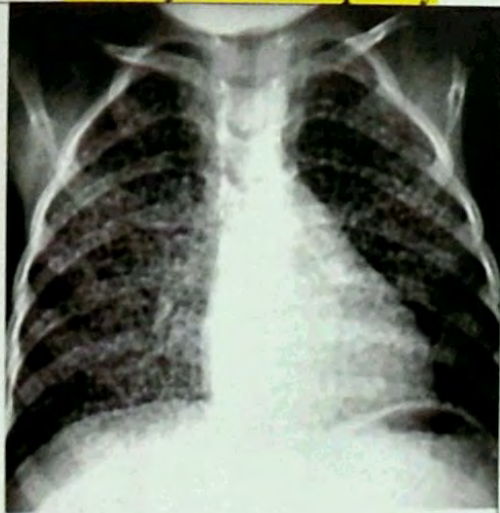
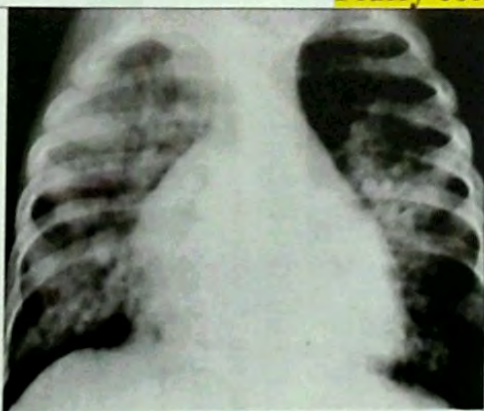
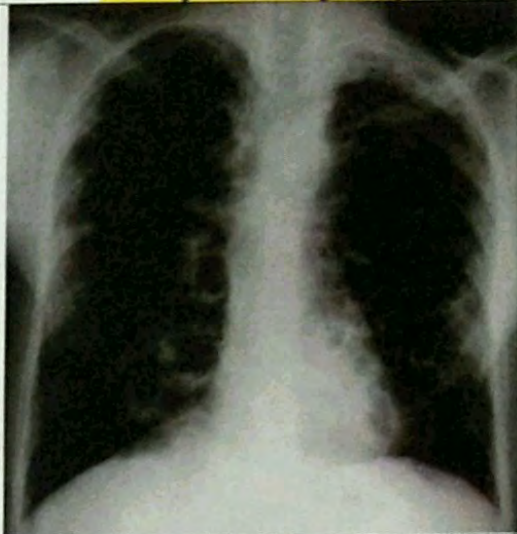


• Shift of mediastinum

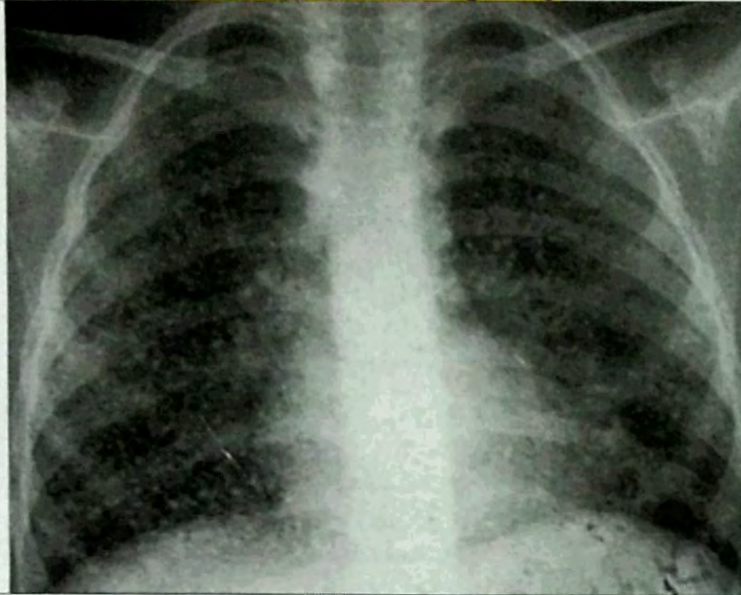
- **Same side :** either
 - Pleural effusion with underlying collapse (or fibrosis) التليف الأقوى **or**
 - Total lung collapse (or fibrosis) , crowded ribs , scoliotic vertebral column , there is compensatory emphysema on the other side



- **Opposite side:** massive pleural effusion. (see before)

II- Heterogenous :			
Miliary shadow opacity	Fluffy cotton opacity		Honey comb opacity
			
Heterogeneous opacities , multiple, bilateral ,			
Diffuse (all over both lungs) Pinpoint (rounded) opacities	Diffuse mainly basal irregular ill-defined opacities give fluffy cotton appearance	Apical ($\pm$ cavitation $\pm$ fibrosis)	basal
➤ Diagnosis : Miliary shadow For DD : - Miliary TB - Lymphangitis - Carcinomatosis - Pneumoconiosis - Sarcoidosis	➤ Diagnosis : Most probably Bronchopneumonia	➤ Diagnosis : Most Probably TB Bronchopneumonia	• Small ring opacities give honey comb appearance • There are hypertranslucency in the upper part of lungs due to emphysema.
			Diagnosis : Most probably Bronchiectasis
			NB : - Lesion maybe unilateral. - Bronchogram : it shows the dilated bronchi as cylindrical, saccular, or fusiform.

Miliary shadow opacity



Bronchopneumonia



TB bronchopneumonia



Bilateral Bronchiectasis

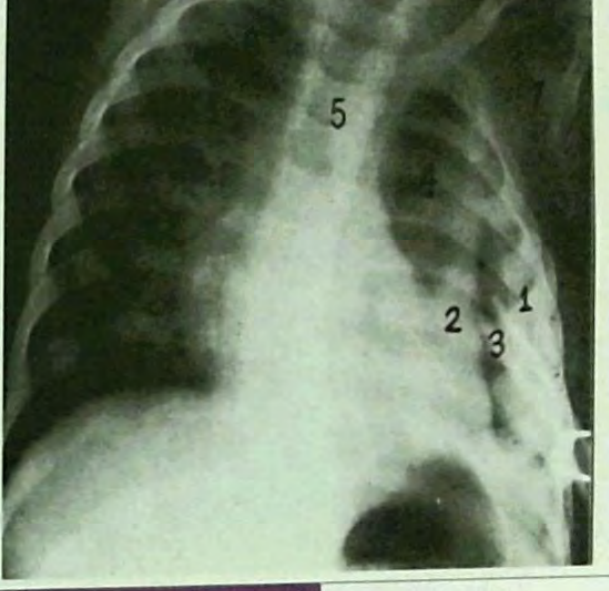


Unilateral Bronchiectasis

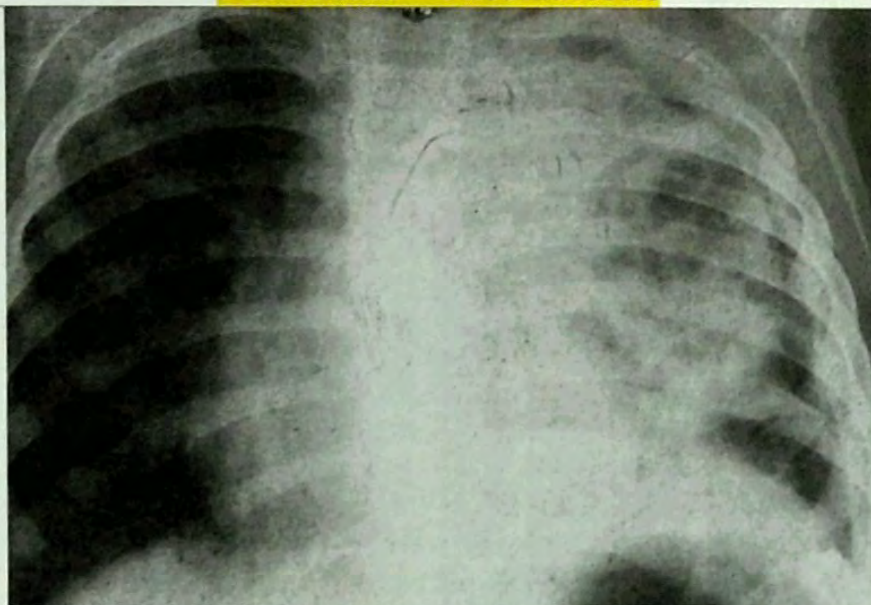


Bronchography of Bronchiectasis



Idiopathic pulmonary Fibrosis (IPF) (Interstitial lung disease) (ILD)	Lung fibrosis (Parenchymatous fibrosis)	Fibrothorax (pleuropulmonary fibrosis)
		
• Bilateral diffuse reticulations & micronodular infiltrations (ground glass appearance) in the interstitial tissue of lungs • Crowded ribs, tenting (elevated) of diaphragm , • Mediastinal shift to the same side of the lesion (± in IPF as it's bilateral disease) • NBs : Types Of Fibrosis : 1. Pulmonary fibrosis : A. Idiopathic pulmonary fibrosis; IPF - Occurs in between alveoli , in the interstitial tissue. B. Parenchymatous fibrosis : - Occurs in lung parenchyma as a complication of various lung diseases e.g. TB & lung abscess 2. Pleuro-Pulmonary Fibrosis = Fibrothorax - Pleural disease may heal by extensive fibrosis that extend to the lung parenchyma as a complication of hemothorax & empyema ➤ Q: What are the differential diagnosis of ground glass appearance ? A: See later.	• Unilateral fibrosis appears as heterogeneous opacity in the left lung parenchyma	1. Unilateral fibrosis appears as heterogeneous opacity in left hemithorax; left pleura and lung pleura more dense (more affected), crowded ribs , mediastinal shift to the same side of the lesion which is left, tenting (elevated) of diaphragm 2. Collapsed lung 3. Chest tube 4. Pneumatocele 5. Scoliotic changes of the spine. 6. Other side (RT) , there is compensatory emphysema. 7. Patient body is tilted to the left side

Pneumonia + Pneumatocele



- **Central** mediastinum
- Heterogeneous radiopaque shadows scattered in the upper, middle & lower part of left lung (**Pneumonia**) intermingled with hyperlucent cystic shadows (**Pneumatocele**)

Congenital diaphragmatic hernia

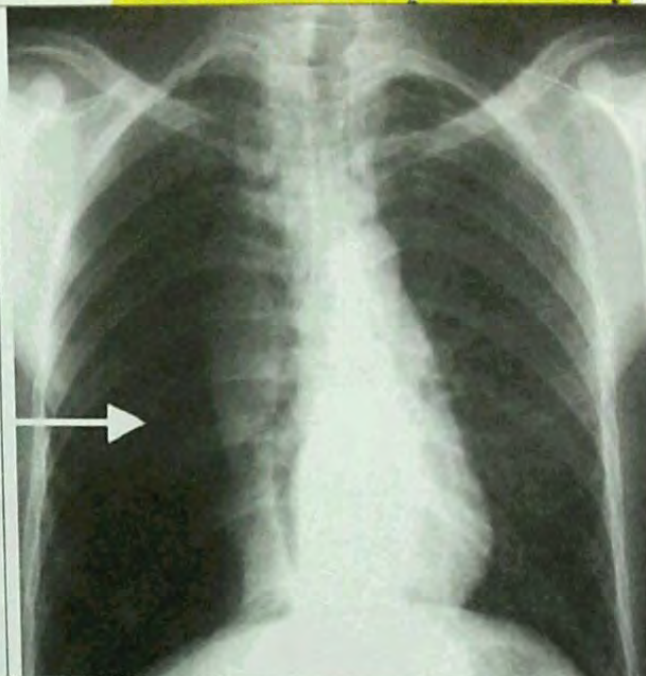
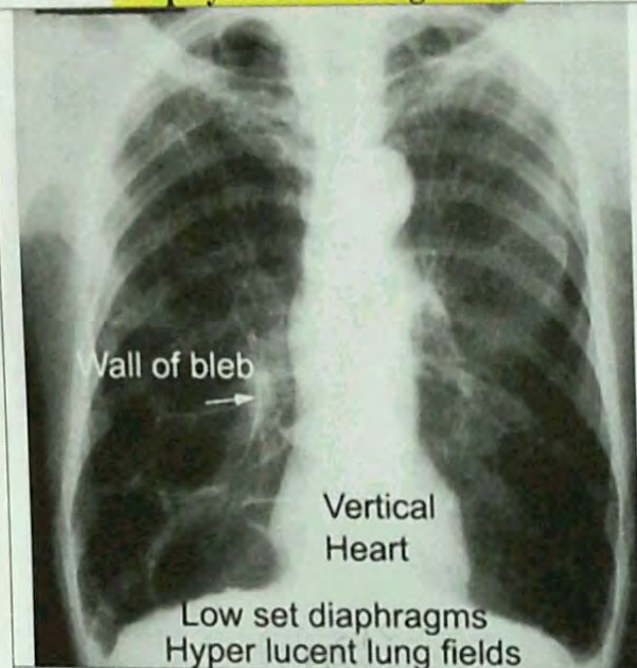


- **Shifted** mediastinum to other side of the lesion.
- Heterogeneous radiopaque shadows simulating pneumonia intermingled with hyperlucent cystic shadows simulating Pneumatocele but there are actually **the herniated intestinal loops ; left side congenital diaphragmatic hernia**

❖ Lung Hypertranslucency:

Emphysema → lung tissue

Pneumothorax → pleural cavity



Bilateral **hypertranslucency** with increased **bronchovascular markings** of voluminous lungs

Unilateral (... side) homogenous jet black **hypertranslucency** with absent **bronchovascular markings** without lung tissue occupying (RT OR LT) hemithorax

Bilateral wide transverse **ribs & intercostal spaces**

Unilateral (... side) wide transverse **ribs & intercostal spaces**

Bilateral low flat **diaphragm** (lower than 10th rib posteriorly)

Look for rib fracture in traumatic pneumothorax

Unilateral low flat **diaphragm** (lower than 10th rib posteriorly)

Central **mediastinum**

Mediastinal shift to opposite side “ tension pneumothorax ”

Heart shadow is elongated “Ribbon shaped heart (decreased cardiothoracic ratio)

Near by underlying **lung** collapse lies close to the mediastinum

NB:

- **Emphysematous bulla** maybe present
- **In case of cor- pulmonale** : the right ventricle enlarges with acute angle
- **Unilateral emphysema** may occur in compensatory cases e.g. collapse , fibrosis or resection.

NB:

- **Intercostal tube** maybe present
- **Encysted pneumothorax**
- **Bilateral pneumothorax**

❖ Q : What are the differential diagnosis of Ground Glass Appearance (GGA) ?

1. Opportunistic infections e.g. atypical pneumonia, pneumocystis carinii pneumonia, cytomegalovirus ,
2. Alveolar disease e.g. alveolar edema e.g. cardiogenic pulmonary edema & acute respiratory distress syndrome
3. Interstitial lung disease (ILD) e.g. hypersensitivity pneumonitis, Hamman-Rich syndrome , Idiopathic pulmonary fibrosis.
4. Neoplastic causes e.g. atypical adenomatous hyperplasia
5. Others e.g. aspergill^osis , sarcoid^osis, lymphangitic carcinomat^osis



Emphysema → lung tissue

Emphysema



Pneumothorax → pleural cavity

Unilateral Pneumothorax



Emphysema with cor- pulmonale



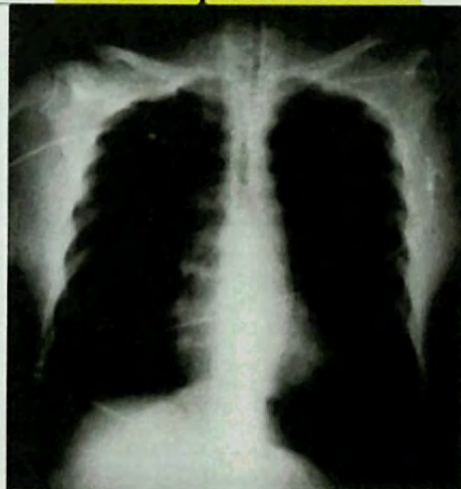
Tension pneumothorax



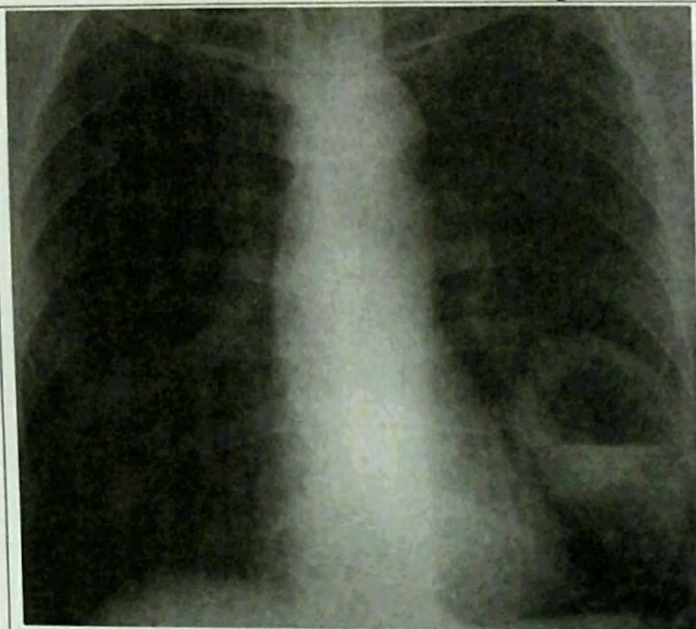
Emphysematous bulla



Bilateral pneumothorax



Examples for full comment



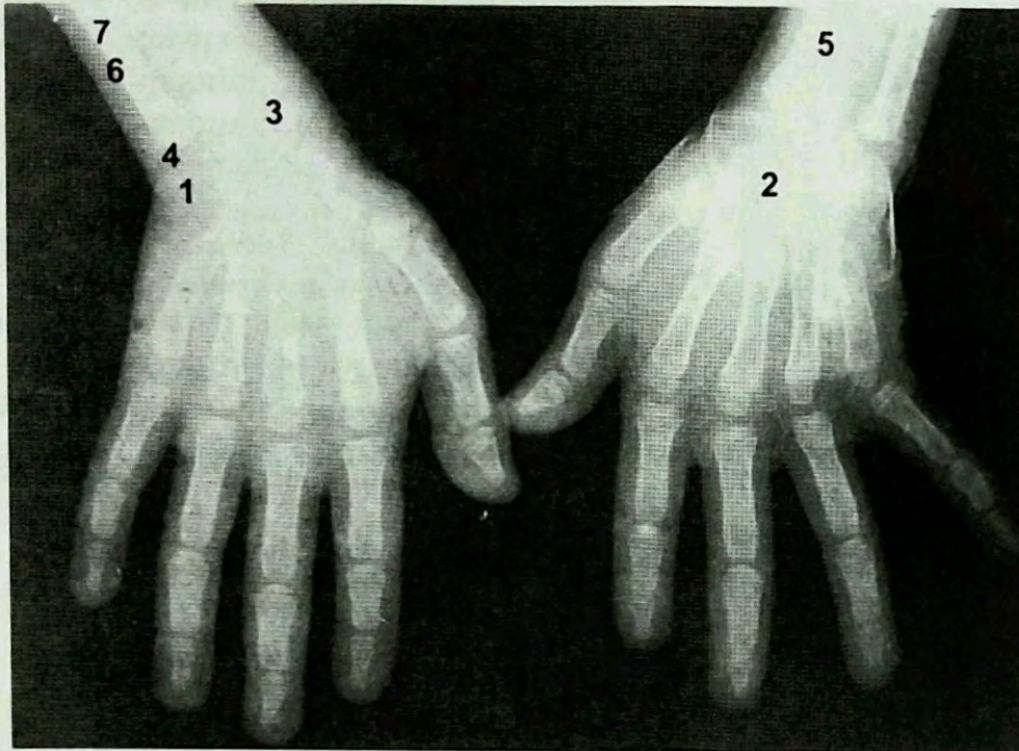
- **P**lain X-ray chest & heart.
- **P**osteroanterior view
- **P**atient is not centralized
- **P**osition of mediastinum (trachea & heart) is central
- **P**atient gender is adult male
- **B**ony cage is intact
- **C**ostophrenic angles are free on both sides
- **C**ardio-thoracic ratio is normal ratio.
- **D**iaphragm :Cuts the 6th rib anteriorly
- **L**ung field : bilateral increase in Bronchovascular markings
- **S**ite, **S**ize, **S**hape, **S**hadow, **S**everity :
 - The left lower lung zone shows homogeneous ring (oval) opacity , 4 x 6 cm with regular thick wall and the cavity showing air fluid level suggesting of chronic lung abscess
- ❖ **Diagnosis : left lower lobe lung abscess**



- **P**lain X-ray chest & heart.
- **P**osteroanterior view
- **P**atient is centralized
- **P**osition of mediastinum :
 - Trachea is central while the heart is shifted to opposite side of the lesion; shifted to the left.
- **P**atient gender is adult male
- **B**ony cage is intact
- **C**ostophrenic angles are free on the left side while in the right side obliterated .
- **C**ardio-thoracic ratio can't be assessed.
- **D**iaphragmatic cupola on the right side : is depressed
- **L**ung field : there is line of pleura forming the lung edge:
- **Outside this line :**
 - **Above :** homogenous jet black hypertranslucency devoid of lung markings
 - **Below :** homogenous opacity obliterating costophrenic angle on the right side & has horizontal Fluid level;(flat upwards) (air fluid level)
- **Inside this line :** the collapsed lung lies close to the mediastinum.
- **Diagnosis :right sided hydropneumothorax**

Bone X-rays

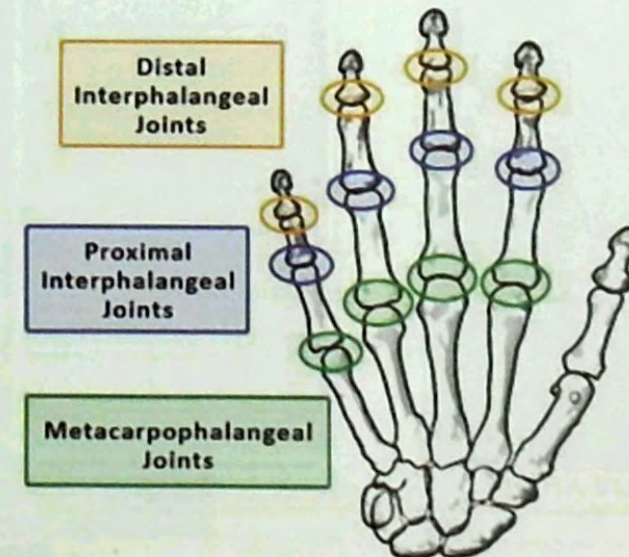
Normal Hand X-Ray



❖ Plain X-ray wrist joints showing :

1. Joint space
2. Ossific centers of carpal bones
Bone age is determined roughly by calculating the number of carpal ossific centers minus one
3. Epiphyseal ossific center (radius)
4. Epiphyseal line (line of provisional calcification)
5. Diaphysis
6. Cortex
7. Medulla

Anatomy of the Hand



Hands & Feet – X-rays

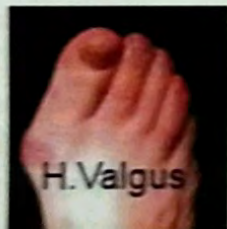
Diagnosis	Rheumatoid arthritis	Acromegaly	Gouty arthritis
	 	 	
View	Plain X-Ray, Hand or foot, Posteroanterior (dorsopalmar)		
Description	• NB: Meta carpo phalangeal (MP) joints, proximal inter phalangeal (PIP) joints • Bilateral symmetrical arthritis affecting : MP & PIP joints • Intercarpal arthritis (amalgamated carpal bones) : - Narrowing of joint spaces - Periarticular osteopenia - Erosion of joints , Subchondral Sclerosis • Deformities e.g. Z shaped thumb deformity, swan neck , Boutonniere deformity, ulnar deviation of at the level of MP joint. • Subluxation e.g. MP joints • Rarefaction (Osteoporosis)	❖ PA view : • Increased (hand or foot) size = bulky sized bones • Increase soft tissue shadow (in hand X-ray called = spade hand) • Mushrooming (tufting) of terminal phalanges • ± Big sesamoid bones • ± Bone rarefaction  	• In Hand : Unilateral (or bilateral asymmetrical) arthritis affecting ... • Irregular articular lines of bones • Extra-articular punched out bone erosion (urate deposits) • Soft tissue shadow of tophi (urate deposits around joints)

Rheumatoid arthritis



❖ In foot :

- Bilateral symmetrical arthritis affecting : metatarsophalangeal joints & interphalangeal joints :
 - Narrowing of joint spaces
 - Periarticular osteopenia
 - Erosion of joints
 - Subchondral Sclerosis
- **Deformities :**
 - Hallux valgus (lateral deviation of big toe)
 - Hammer toes (flexion deformities)



H.Valgus



Hammer T.

Acromegaly



❖ Lateral View :

- Big sized feet
- Increased calcaneal pad thickness (>2.5 cm)



Gouty arthritis

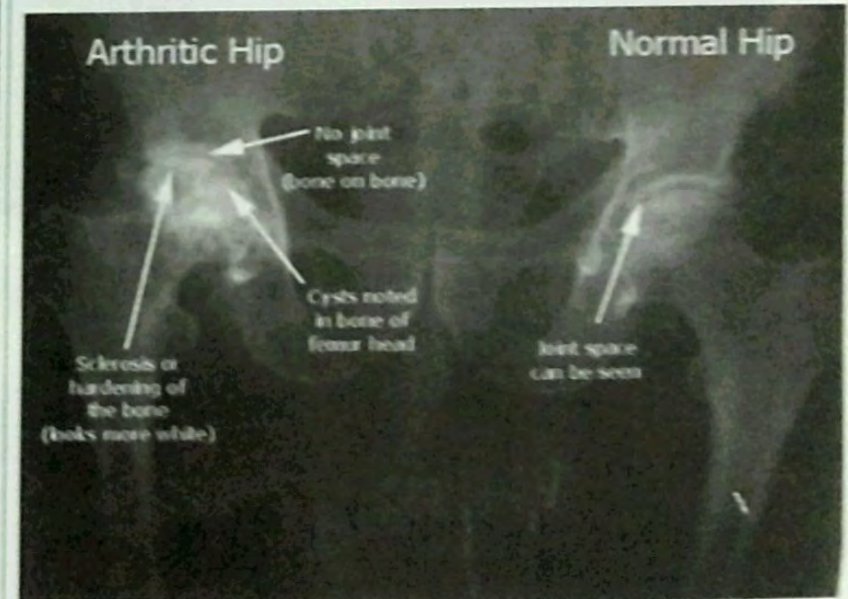


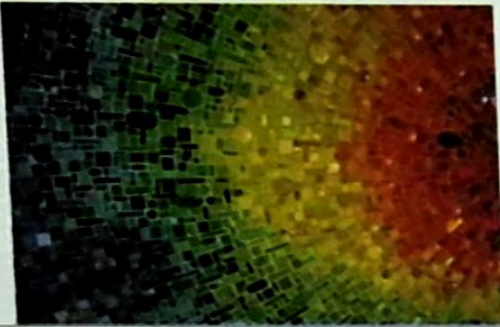
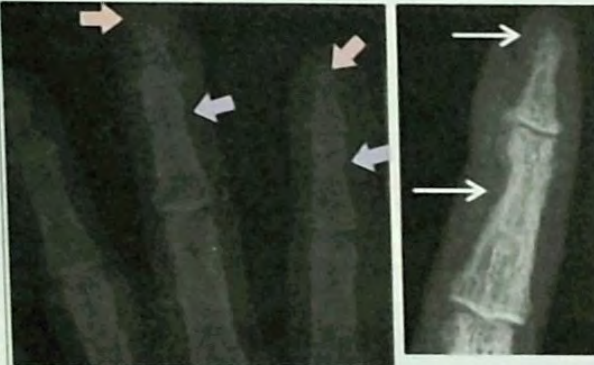
- In Foot : arthritis affecting first MP joint (Big toe) & same comment.



Osteoarthritis (OA)

- View : Plain X-Ray, Hand or foot(hip, knee ,leg), Posteroanterior or lateral.
- Description :
 - **Bilateral symmetrical arthritis affecting DIP ($\pm$ PIP) :**
 - Narrowing of joint spaces
 - Periarticular osteopenia
 - Erosion of joints e.g. DIP joints
 - Subchondral Sclerosis
 - **Osteophytes giving Herberden (DIP) & Bouchard (PIP) nodules**
 - No or minimal deformities

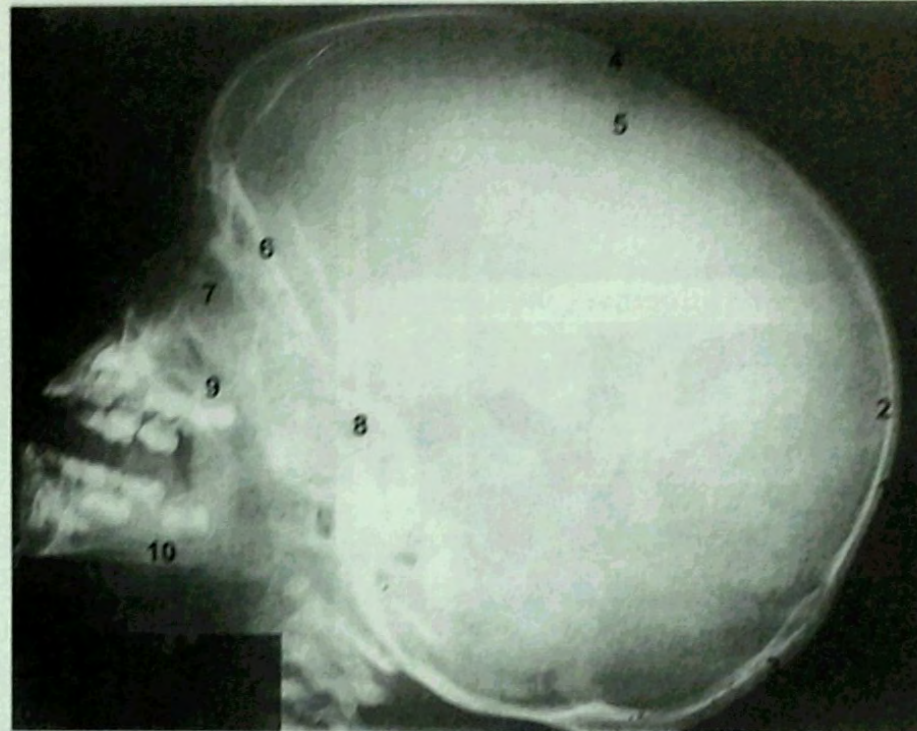


Diagnosis	Hemolytic anemia	Hyperparathyroidism	Scleroderma
	 	 	
View	Plain X-Ray, Hand, Posteroanterior (dorsopalmar)		
Description	- Boxing of bones & loss of waist (rectangular shape) - Thin cortex & wide medulla cavity - Lattice pattern due to trabeculation of bones (mosaic appearance) - Decreased bone density	Resorption of terminal phalanges Subperiosteal phalangeal bone resorption (specially affecting middle phalanges) ± Osteolytic lesion (Brown tumor)	Resorption of terminal phalanges Calcification in soft tissues of fingers

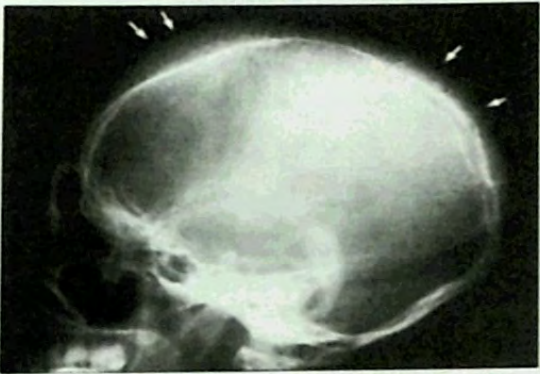
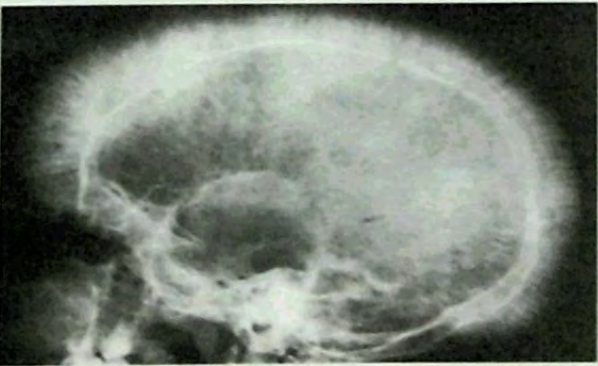
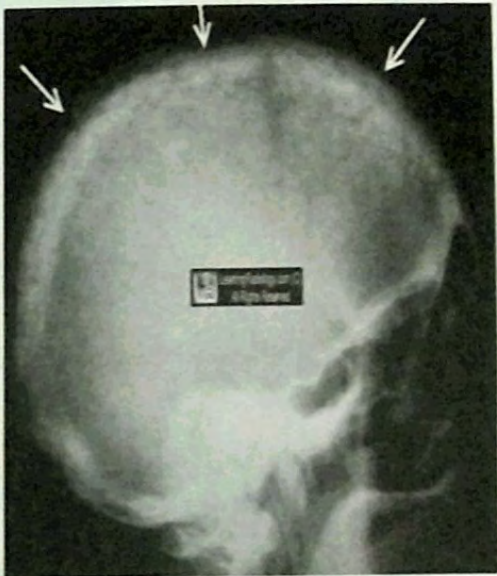
Diagnosis	Calcaneal spur			
				
View	• Plain X-Ray, foot, Lateral			
Description	• Spike or spur projecting from the calcaneal bone			
	Hyperparathyroidism			
				

Skull – X-rays

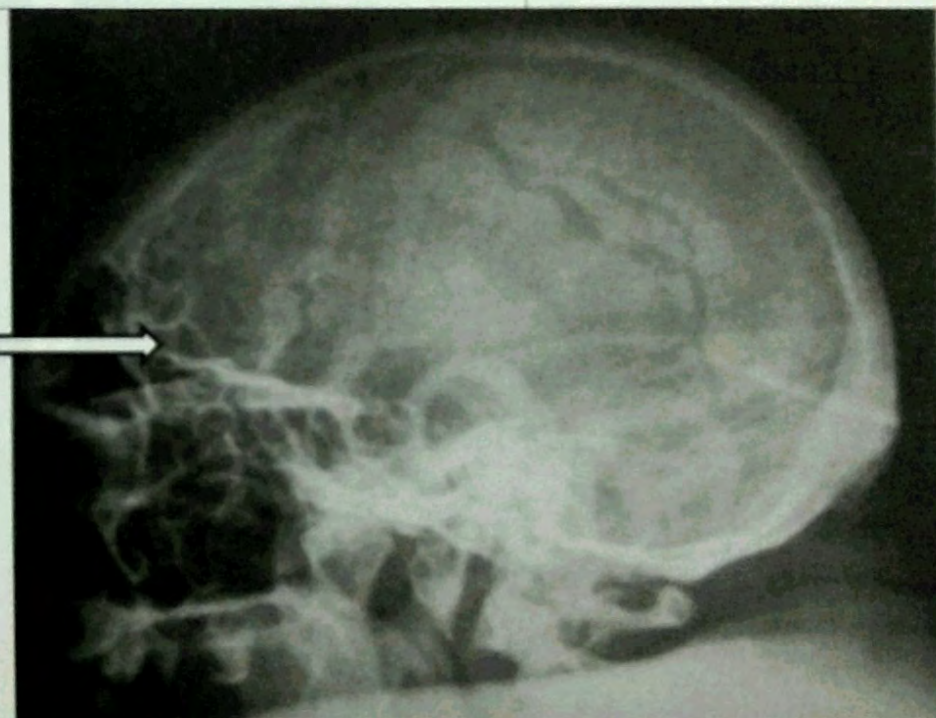
Normal Skull X-ray

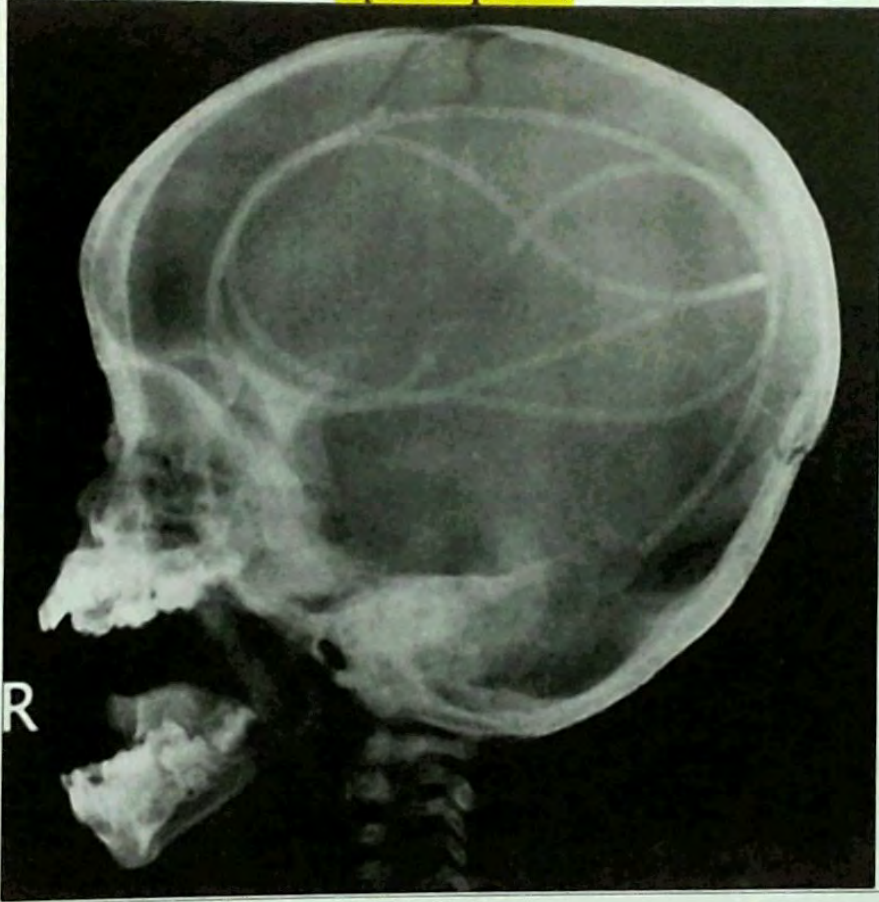


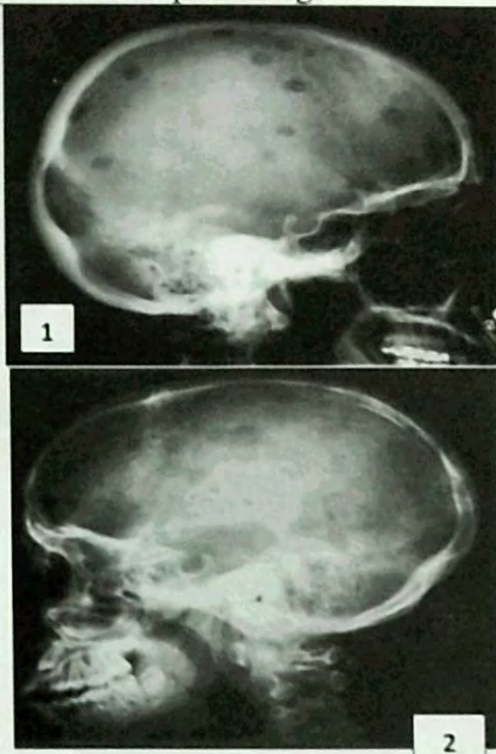
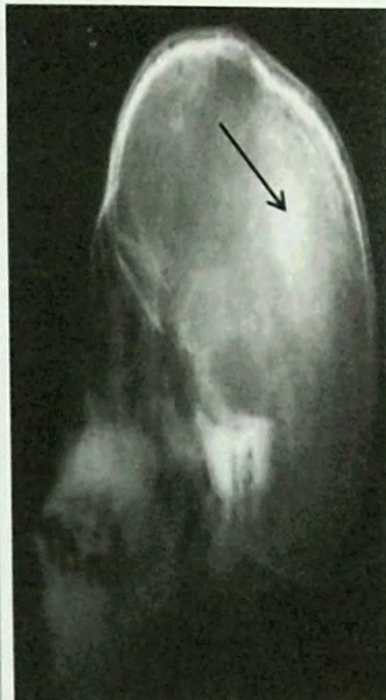
1. Outer table
2. Inner table
3. Diploic space
4. Anterior fontanelle
5. Coronal suture
6. Roof of the orbit
7. Orbit
8. Sella turcica; normally admit less than little finger.
9. Maxilla
10. Mandible

Diagnosis	Acromegaly	Hemolytic anemia	Paget disease of the bone
	 	  	 

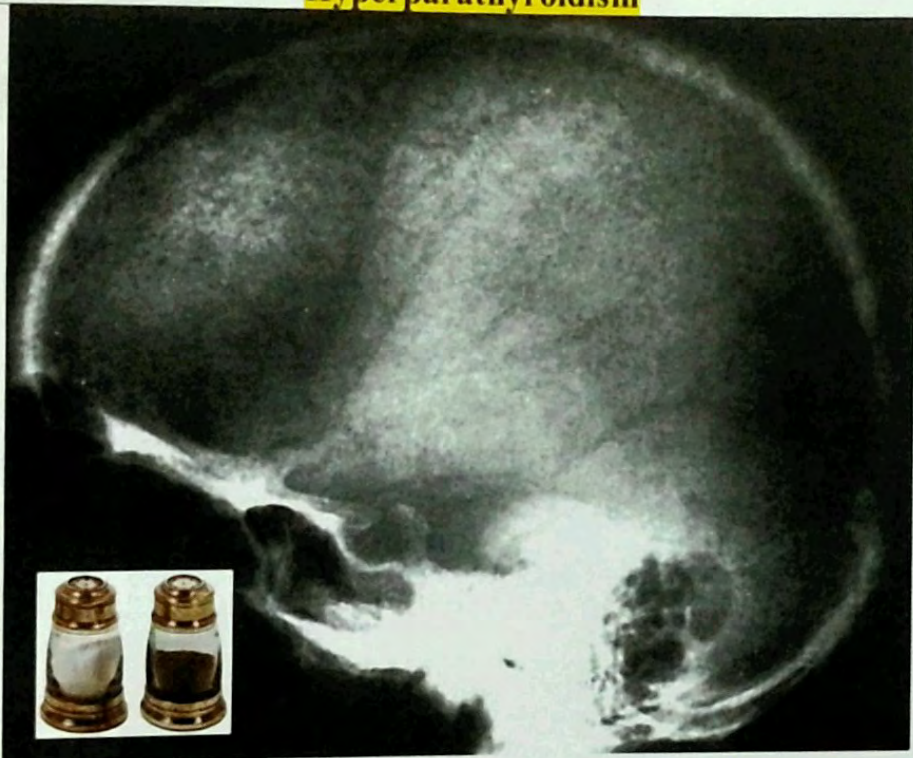
View	Acromegaly Plain X-Ray, Skull, Posteroanterior or lateral	Hemolytic anemia Plain X-Ray, Skull, lateral	Paget disease of the bone Plain X-Ray, Skull, Lateral
Description	❖ Posteroanterior view : • Big skull • Increase Thickening & widening of skull diploic space • Thick cortex. • Pneumatization (Increase) frontal and maxillary air sinuses • Prominent orbital margins • Teeth either widely separated or falling ❖ Lateral View = PA + • Ballooning or widening(>little finger) of sella turcica • Bossing of forehead • Prognathism (protruded lower jaw) • Prominent external occipital protuberance • Big soft tissue shadows: ears, tongue & skin folds in nape. • ± Silver Beaten appearance = finger prints (↑ICT in adults)	• Big skull • Increase thickening & widening of skull diploic space • Generalized rarefaction • Subperiosteal new bone formation in the form of radiating perpendicular widely separated prominent bony trabeculae giving hair on end appearance.	• Big skull • Increase thickening & widening of skull diploic space • Generalized sclerosis(multiple irregular sclerotic patches) producing cotton wool skull



Diagnosis	Hydrocephalus	Craniosynostosis
		
View	Plain X-Ray, Skull, lateral	Plain X-Ray, Skull, lateral
Description	• Big cranium & small face (disproportionate cranio-facial portions) • Thin skull bones • $\pm$ Wide separation of sutures ($\uparrow$ICT in children) • $\pm$ Shunt operation	• Absent sutures (premature closure of sutures) • Silver beaten appearance = finger prints • Widening of sella turcica • $\pm$ Prominent anterior fontanel 

Filling defect(s) لونه إسود				Filling defect(s) لونه أبيض	
	Single filling defect	Miliary filling defect	Multiple filling defect		Osteosclerotic metastasis
View: Plain X- Ray, Skull, lateral					
Descript ion	Single rounded filling defect for DD	Diffuse (miliary) pin point rounded filling defects giving rise to salt & pepper skull 	1. Multiple , rounded, regular , well defined punched out (clearly cut), equal size filling defects	2. Multiple , rounded, irregular , ill-defined ± bone erosion , variable size filling defects	Multiple hyperdensity (Osteosclerotic) lesions
	❖ Single filling defect DD: - Trephine operation - Depressed fracture Single osteolytic metastasis		Hyperparathyroidism	Multiple myeloma	Multiple osteolytic metastasis
Diagnos is					

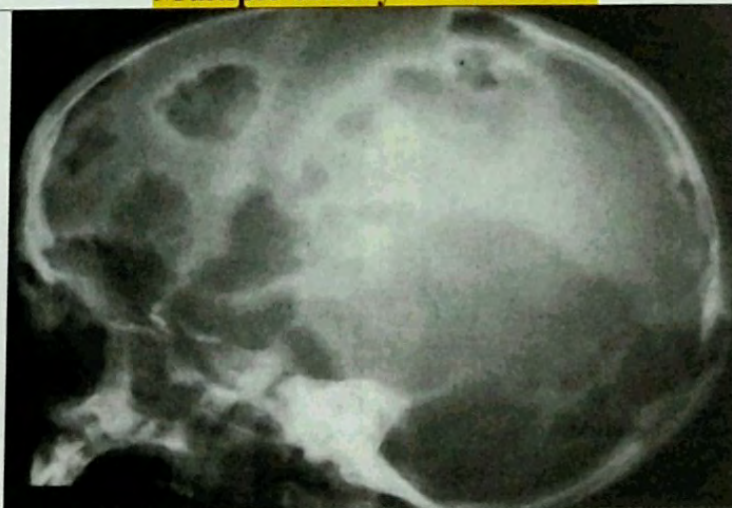
Hyperparathyroidism



Multiple myeloma



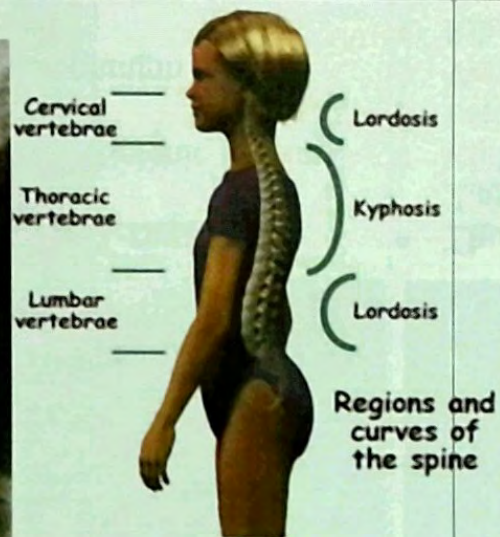
Multiple osteolytic metastasis



Vertebral column -X-rays

Normal Cervical Spine X-ray

Cervical



• Cervical Spine X-ray: AP view:

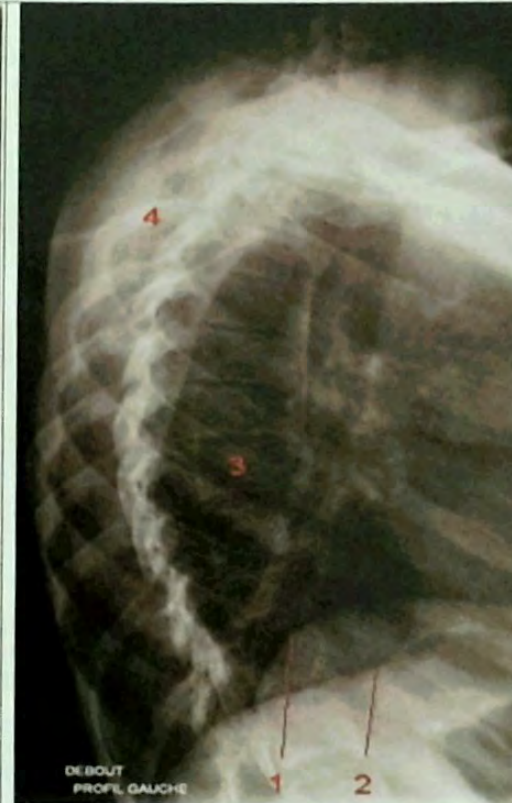
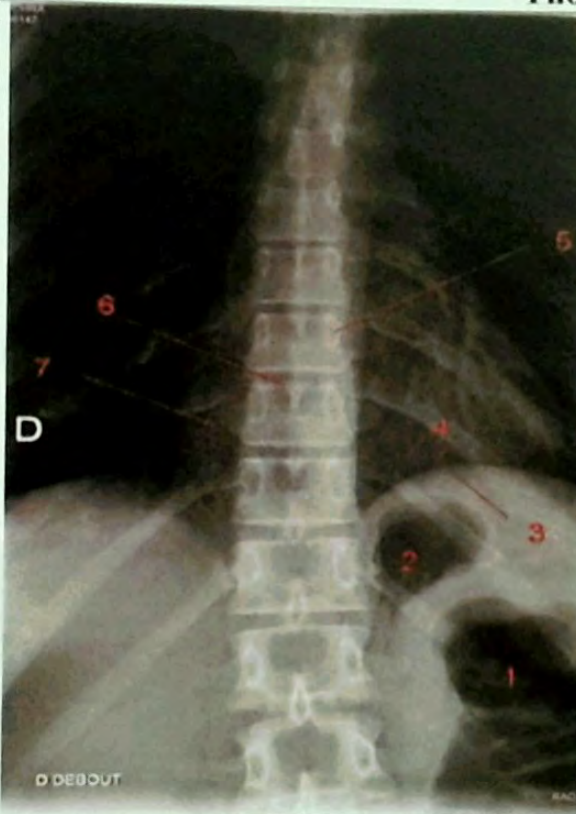
1. Clavicle.
2. 1st rib
3. Trachea.
4. Spinous process of C7
5. Vertebral Body of C5.
6. Uncinate process.

• Cervical spine X-ray : lateral view:

1. Vertebral body (TH1)
2. Spinous process of C7
3. Lamina
4. Inferior articular process
5. Superior articular process
6. Spinous process of C2
7. Odontoid process
8. Anterior arch of C1 (atlas)
9. Trachea

Normal Thoracic Spine X-ray

Thoracic



• Thoracic Spine X-ray

AP view:

1. Left ventricle
2. Gas in stomach.
3. Right hemidiaphragm.
4. Posterior rib
5. Clavicle.

• Thoracic Spine X-ray:

AP view :

1. Gas in Colon (Splenic flexure).
2. Gas in stomach
3. Left hemidiaphragm
4. Posterior rib
5. Pedicle
6. Spinous process
7. Transverse process.

• Thoracic Spine X-ray:

Lateral view:

1. Right hemidiaphragm
2. Left hemidiaphragm.
3. Vertebral body
4. Rib.

• Thoracic Spine X-ray: Lateral view:

1. Posterior rib
2. Vertebral body
3. Intervertebral discal space.

Normal Lumbar Spine X-ray

lumbar



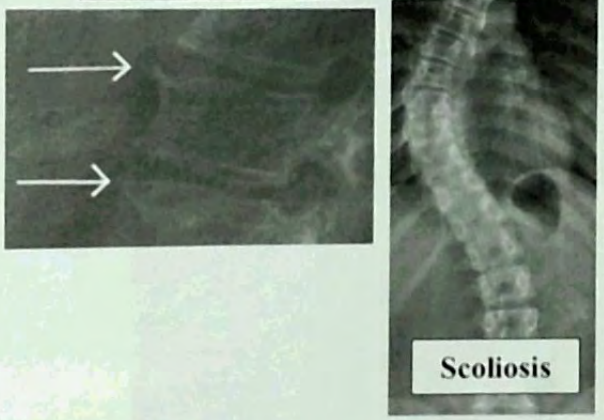
• Lumbar spine x ray AP view:

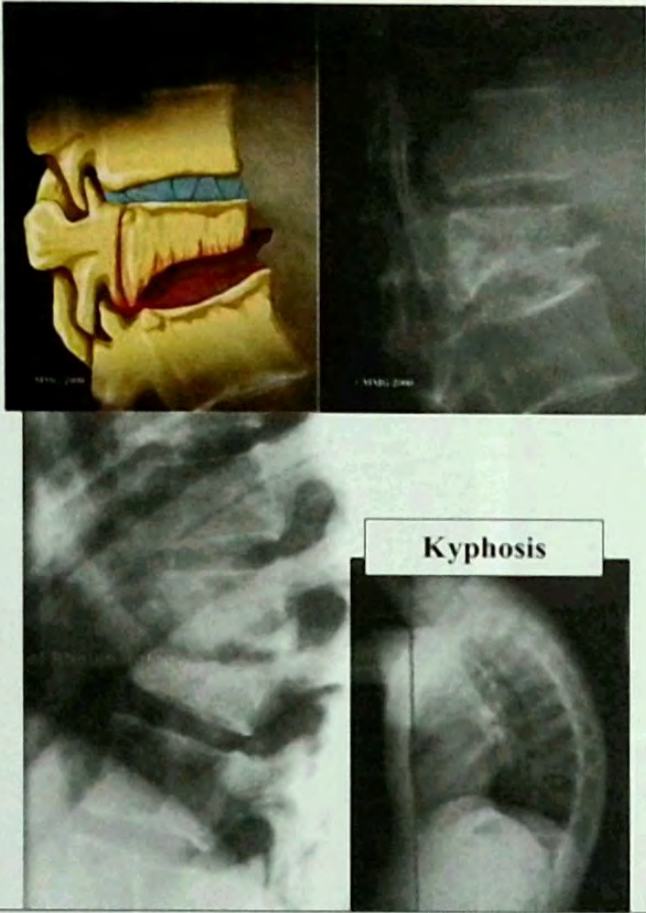
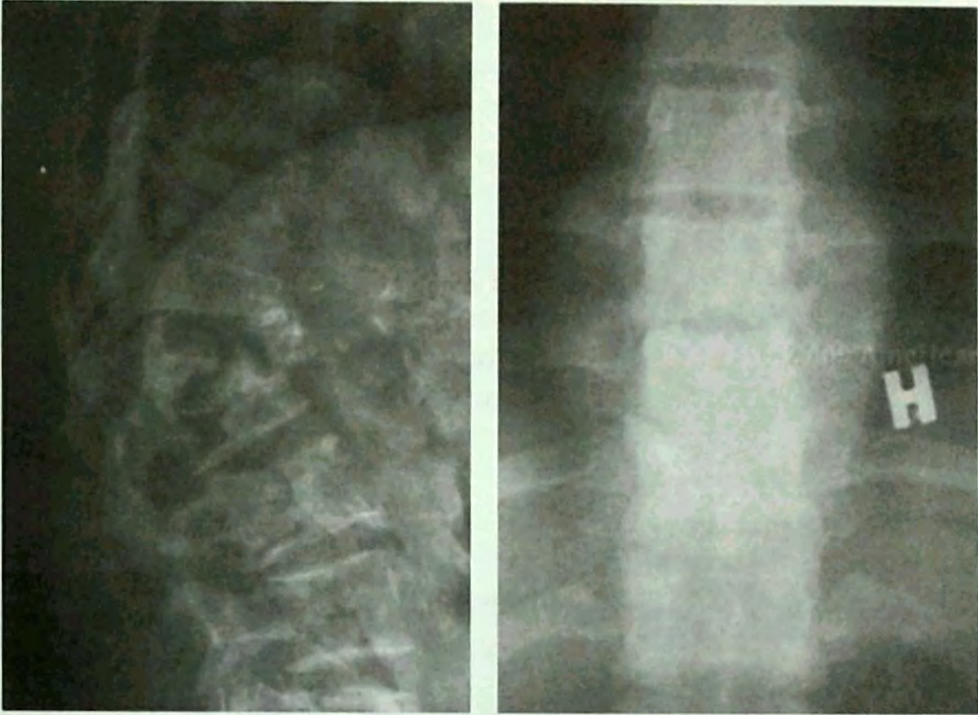
1. Rib
2. Transverse process
3. Pedicle
4. Spinous process
5. Sacrum
6. Sacroiliac joint

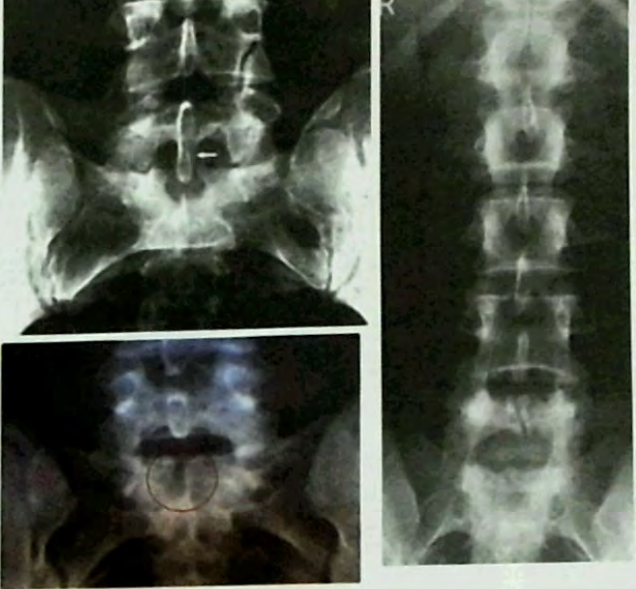


• Lumbar spine x ray , lateral view :

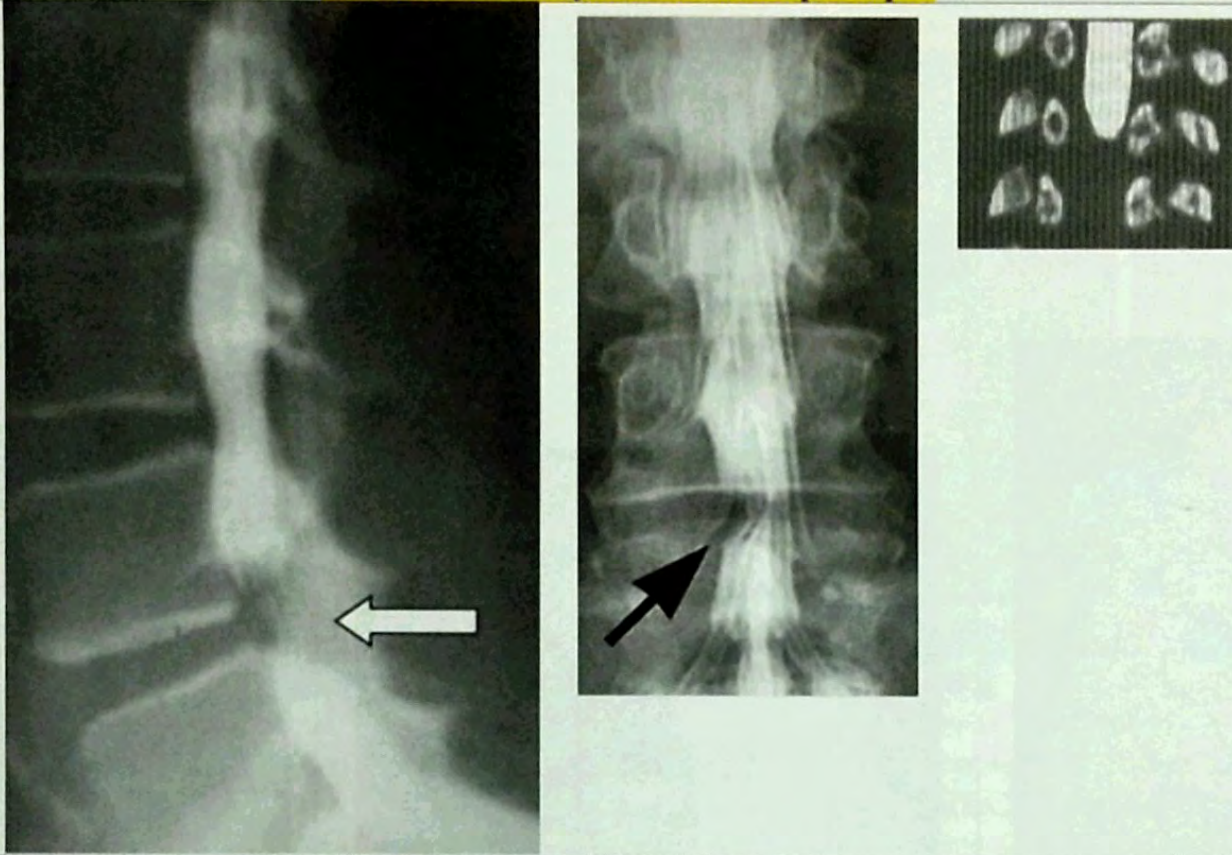
1. Sacrum
2. Spinous process
3. Vertebral body
4. Intervertebral disc space
5. Intervertebral foramina
6. Pedicle
7. Inferior articulating facet
8. Superior articulating facet
9. rib

Diagnosis	Spondylosis	Spondylolisthesis	Ankylosing spondylitis
	 	 	
View	Plain X-Ray, Vertebral column,		
	Posteroanterior or lateral	lateral	Posteroanterior or lateral
Description	- There are osteophytes (lipping) ± Narrowed space(s) ± Changes curvature : - <u>Scoliosis</u> in PA view i.e. S shaped deformity of the spine or - <u>Loss of lordosis</u> in lateral view i.e. diminished curvature of the spine	- Forward (Backward) displacement of vertebra ... over ... - Commonest sites : - L4 over L5 OR - L5 over sacrum	1. Calcification of lateral longitudinal ligaments giving bamboo spine. 2. ± Calcifications of posterior ligaments giving dagger sign 3. ± Obliteration of sacro-iliac joint space (Sacroiliitis)

Diagnosis	Traumatic Fracture vertebra (Compression Fracture)	Pathological Fracture vertebra (most probably Pott's disease; TB)
	 The images for Traumatic Fracture include an anatomical diagram of a vertebral compression fracture, a lateral X-ray showing a fracture in a vertebral body, and another X-ray with a label 'Kyphosis' pointing to an exaggerated forward curvature of the spine.	 The images for Pathological Fracture show two X-rays of the vertebral column. The left image shows a fracture in a vertebral body, and the right image shows a fracture in a vertebral body with a label 'H' pointing to a specific area.
View	Plain X-Ray, Vertebral column, Posteroanterior or lateral	
Description	• Fracture of one vertebra • Normal density vertebra • Preserved disc space • Kyphosis (exaggerated curvature of the spine)	• Fracture of more than one vertebra (... & ...) • Rarified vertebrae • Narrowed disc space • Kyphosis • $\pm$ soft tissue shadow (cold abscess)
	Fracture ... vertebra, most probably traumatic	Fracture (... & ...) vertebra, most probably Pott's disease (TB)

Osteoporosis of the spine	Spina bifida	Cervical rib
		
Plain X-Ray, Vertebral column, Posteroanterior or lateral	Plain X-Ray, Vertebral column, Posteroanterior	Plain X-Ray, Vertebral column, Posteroanterior
• Generalized rarefaction of vertebral bodies (osteopenia) • Biconcave vertebral outline = cod fish spine • ± Widened spaces • ± Deformities (specially Kyphosis) • ± Pathological fracture. 	• Bony defects in the posterior portion of the neural arch i.e bifid spinous process (spinous process not seen) due to failure of fusion of vertebral laminae posteriorly giving bifid spine.	• Short, thin , bilateral or unilateral , additional rib articulating with C7 instead of T1

Contrast = Myelogram

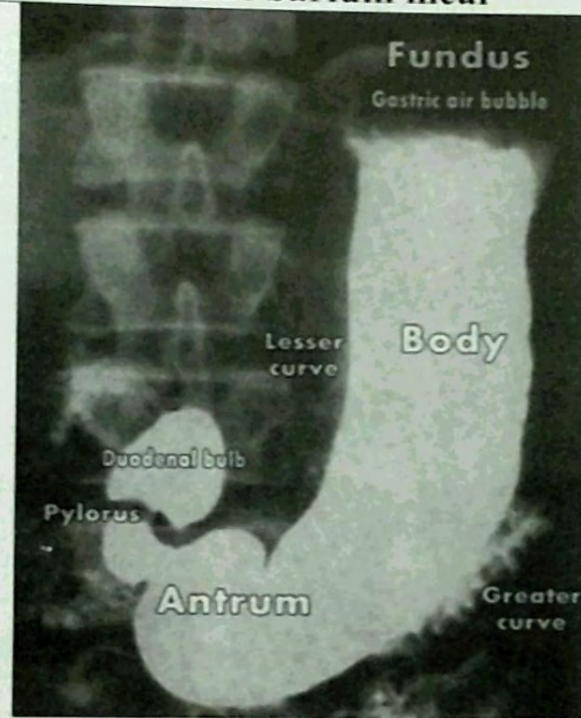
Diagnosis	Extra-medullary block = disc prolapse	Intra-medullary block
		
View	Contrast X-ray on the vertebral spine , Posteroanterior or lateral	Contrast X-ray on the vertebral spine , Posteroanterior
Description	• Interruption (or indentation or complete arrest) of dye at disc between ... & ... - Commonest site : space between L4 & L5 • $\pm$ Narrow space • Saddle shape	• Central filling defect (localized ballooning) with thin tails on either side • Fusiform shape

GIT & UROLOGY

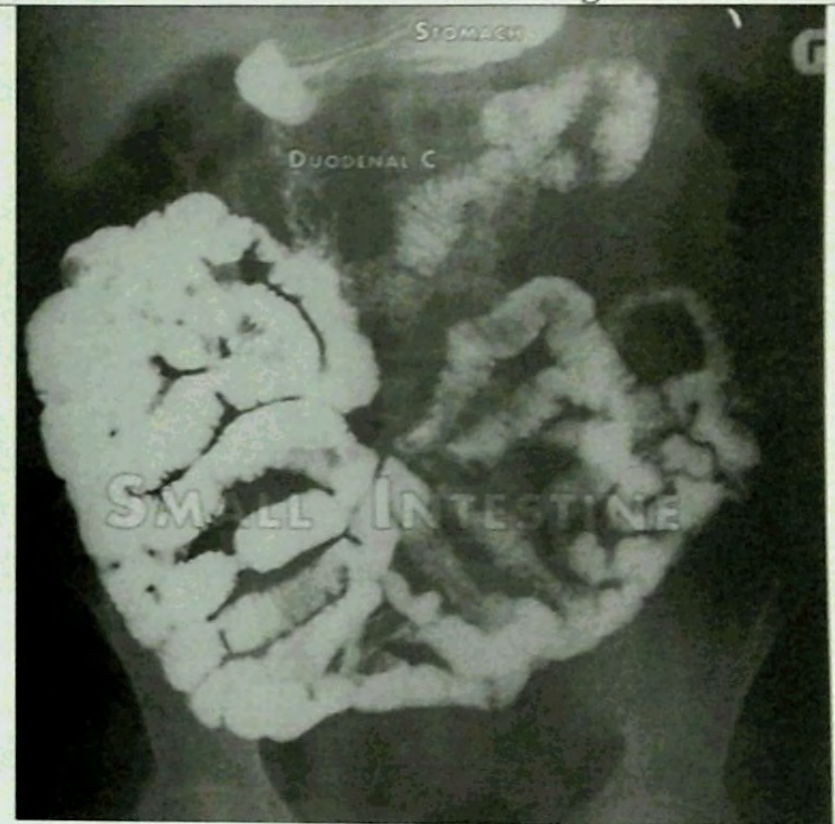
Normal barium swallow



Normal barium meal



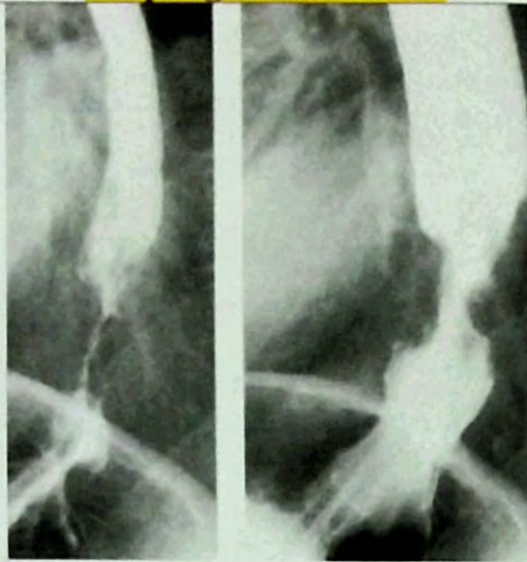
Normal follow through



A-Contrast X-Rays

I-Barium swallow = Oesophagus

Esophageal carcinoma



- Persistent irregular filling defect with shouldering or rat tail appearance.
- Usually in the middle of 1/3 of esophagus
- **No** marked proximal dilatation.

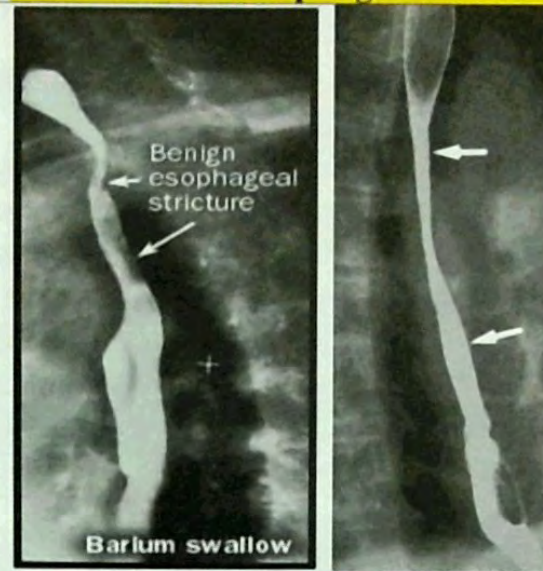


Achalasia of the cardia



- Smooth narrowing of the lower end of the esophagus (Hen's peak or Parrot's peak)
- At the level or just below diaphragm
- **Marked dilatation** with a fluid level
- No gas bubble in the fundus of the stomach.

Post corrosive esophageal stricture



- Smooth, long, multiple strictures
- Usually at T4 & the two ends of the esophagus.
- No marked dilatation above the strictured segment.

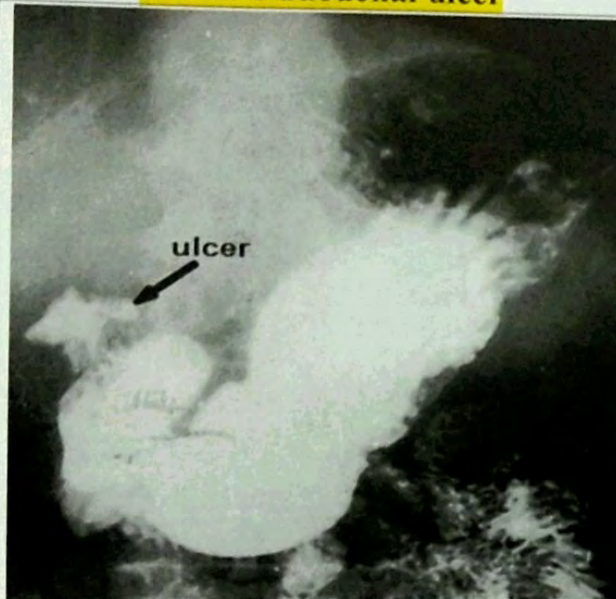
Esophageal varices



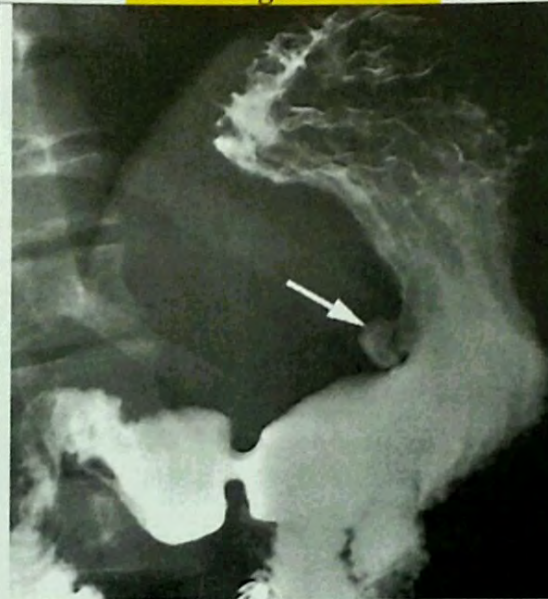
- Multiple smooth rounded & longitudinal filling defects
- Starting from lower 1/3 of the esophagus,

II-Barium meal = stomach & duodenum

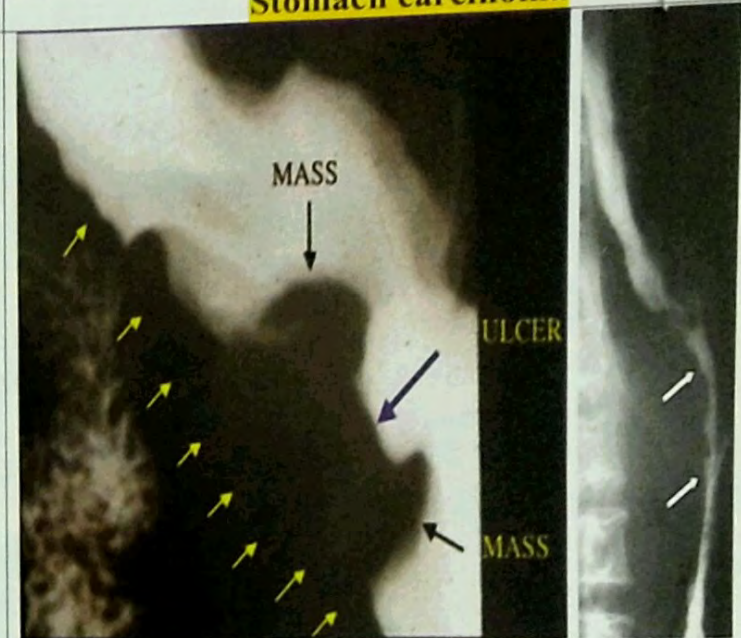
Chronic duodenal ulcer



Chronic gastric ulcer



Stomach carcinoma



❖ Barium meal show one or more of the following :

- **Ulcer niche full of barium in duodenal cap**

- Persistent deformity of duodenal cap in **serial study** due to spasm and later fibrosis
- NB : an example for common deformity is **trifoliate deformity**



- **Stomach is steer horn (hypertonic)**



- **Ulcer niche full of barium usually on lesser curvature** and projects to outside the stomach

- Notch on greater curvature opposite the ulcer niche appears as smooth filling defects due to spasm and later fibrosis of circular muscle fibers

- **Stomach is J shaped (hypotonic)**

- If it presents as a **mass**, it will be as persistent irregular filling defect.
- If it presents as a **malignant ulcer**, it will be in the antrum or greater curvature
- **Linitis plastica : leather bottle stomach** marked narrowing of the lumen of the stomach due to diffuse carcinoma of the stomach converting it into narrow irregular tube but the flow of barium is not interrupted



Congenital hypertrophic pyloric stenosis



- The pyloric canal is very thin, prolonged (**string sign**)
- The duodenal cap is **umbrella shaped**.
- Delayed gastric emptying

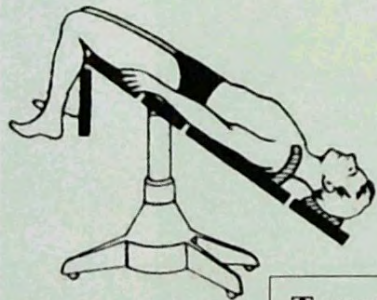
Chronic pyloric obstruction



- There is huge **proximal dilatation** of the stomach till the pelvis giving the picture of **soup-dish or soup-plate appearance**
- Wide smooth antrum

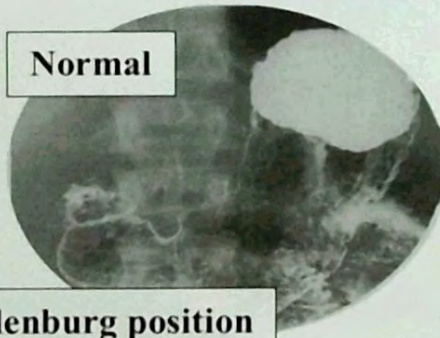
Sliding hiatus hernia

- Barium meal in Trendelenburg's position, Barium at the fundus of the stomach
- The esophagus is opacified (reflux), **Epiphrenic bulge** (part of stomach is seen above the diaphragm)



Trendelenburg position

Normal



Carcinoma of the head of pancreas



- **Wide C curve of the duodenum** (normally doesn't exceed one vertebra)

Pancreatic pseudocyst

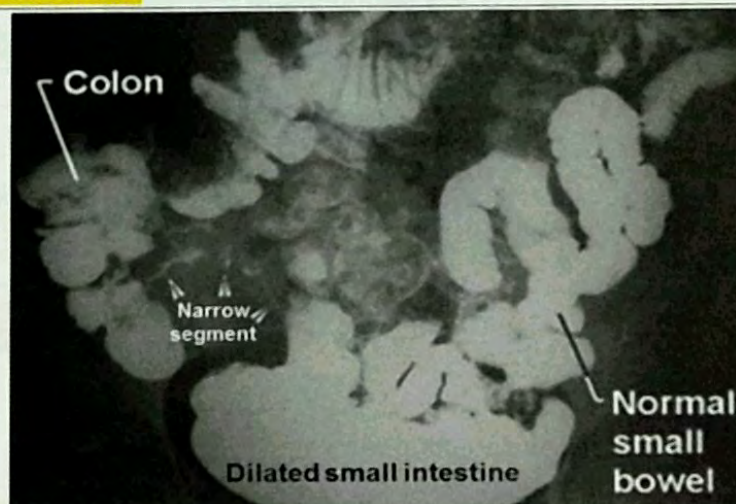


- **Displacement and compression of the stomach**

III-Barium follow through = small intestine

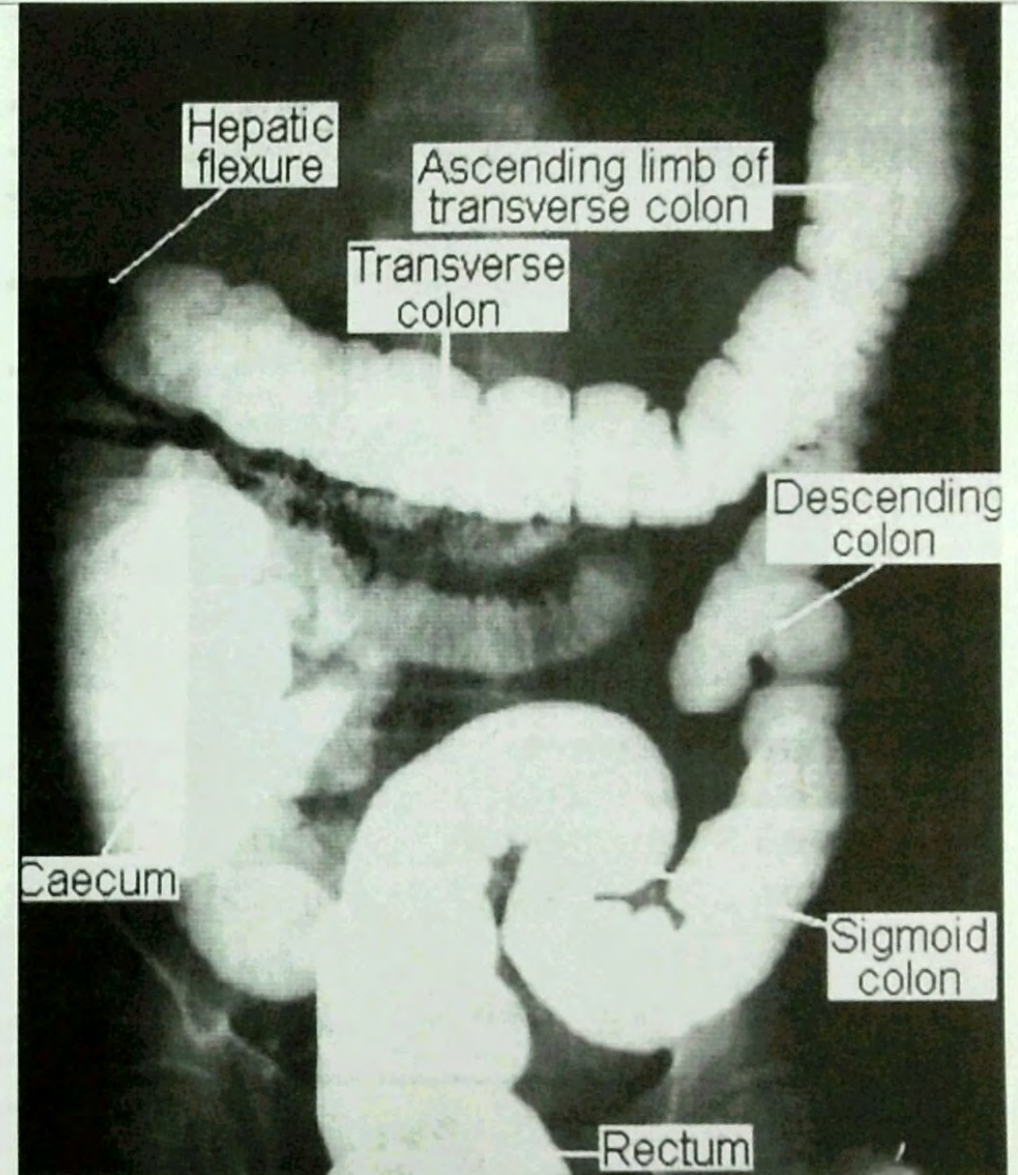
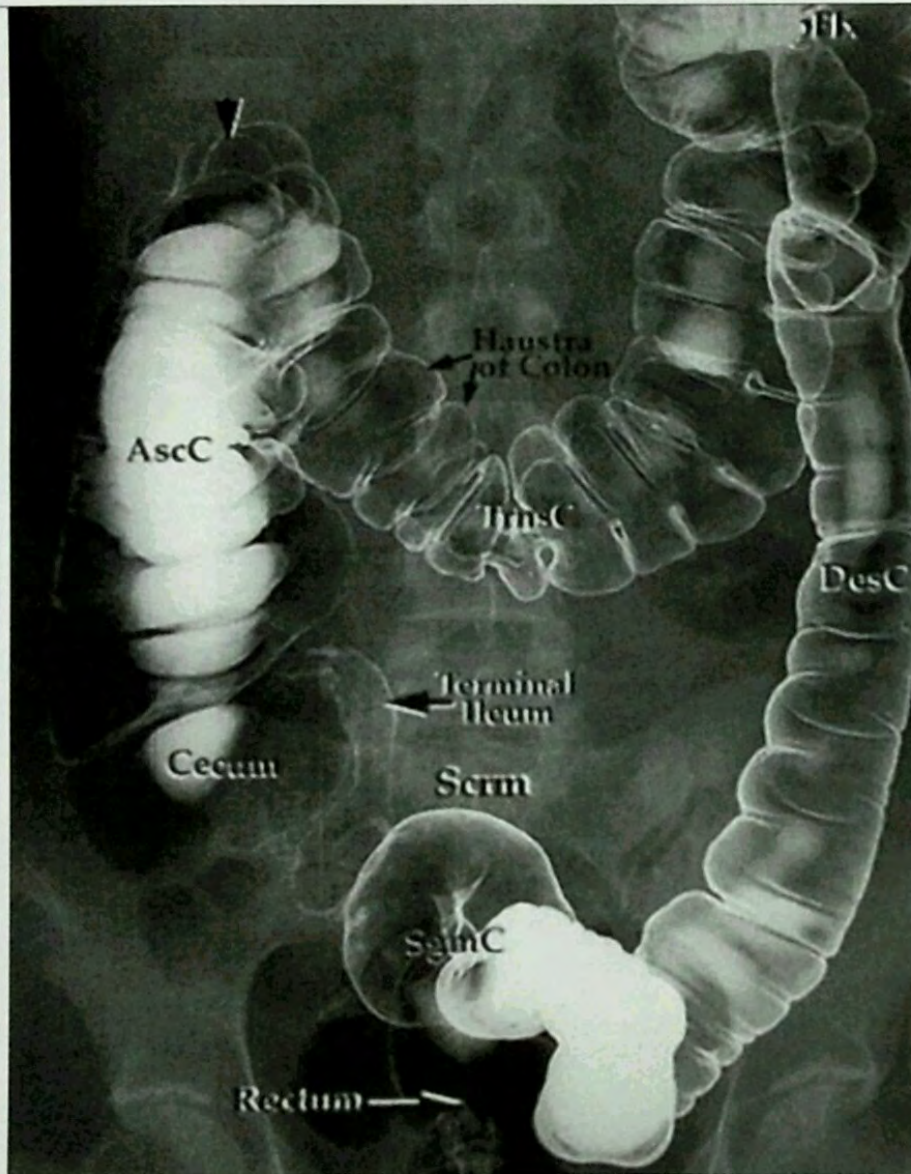
Crohn's disease

- ❖ May show one or more of the following :
 - Site : **terminal ileum** is the most commonly affected site
 - **Segmental areas of narrow irregular stricture**
 - Cobble stone appearance of the mucosa caused by ulceration of mucous membrane with edema of intervening mucosa
 - Internal or external fistulae
 - Polyps may be seen
 - **Skip lesions:** areas of normal bowel between the lesions
 - The finding of narrowed terminal ileum segment is known as the **string sign of Kantor**



IV-Barium enema = colon

Normal barium enema



Colon carcinoma



- Fixed irregular filling defect.
- Annular strictures of the left colon show characteristic “shouldering with apple core appearance”



Ulcerative colitis



- **Rectum** with or without variable segments of the colon are affected
- Wide spread ulcers with “granular or ground ulcer appearance”
- **Loss of haustrations**
- Narrowing, shortening of colon → **Pipe stem appearance**
- Polyps may be seen
- No skip lesion
- The terminal ileum not affected



Polyposis coli



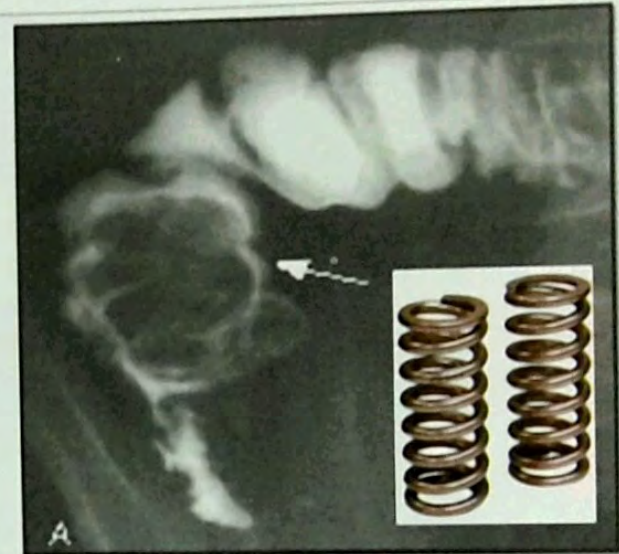
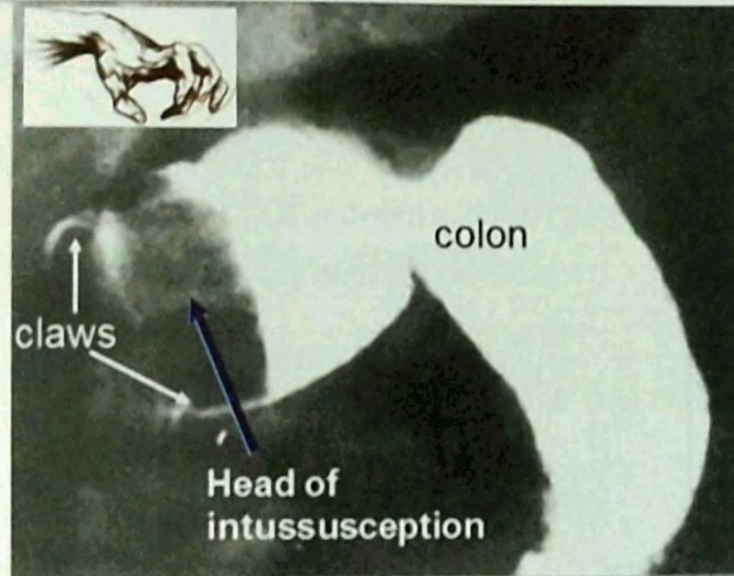
- Types : bilharzial, familial or Gardner's syndrome
- **Multiple rounded filling defects**
- In Bilharziasis it is usually limited to sigmoid colon
- In familial polyposis it affects the whole colon

Diverticular disease of the colon "Diverticulosis"



- ❖ It may show one or more of the following :
 - In the prediverticular stage : A **saw teeth appearance** of the colon.
 - Then fully developed diverticulae will be visualized as **protrusions full of barium**
 - Fistulae as colo-vesical or colo-vaginal fistula may develop as a complications.

Intussusception



- The barium will fill the colon until it stops at the area of intussusception where a cylindrical filling defect appears and there is arrest of further progress of contrast (**claw sign or meniscus sign & coiled spring sign**)

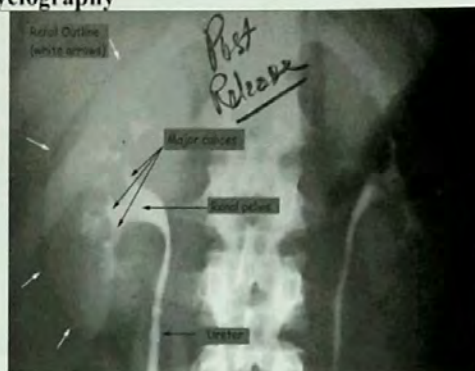
V- Oral cholecystography



- Now it has been nearly replaced by ultrasonography
- Method :**
 - The patient fasts for 12 hours before the examination and swallows 6 tablets of telepaque (tetraiodophenolphthalin)
 - The contrast material is absorbed, secreted by the liver in the bile and passes via cystic duct to be concentrated in the gall bladder
- Normally the gall bladder will be well opacified
- Radiolucent stones will appear as filling defects**

VI- Pyelography

Normal Pyelography



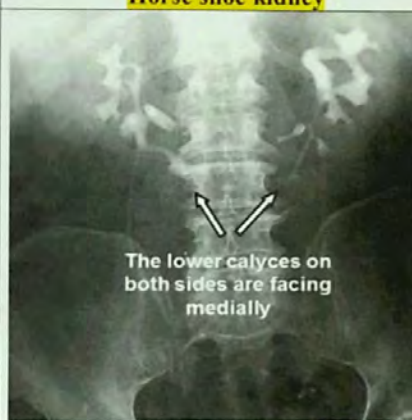
Types :

- Descending = intravenous pyelogram , Ascending = retrograde pyelography

Double pelvis, double ureter



Horse shoe kidney



- Duplex collecting systems can be unilateral or bilateral
- **The kidney has 2 pelvi-calyceal systems & 2 ureter.**
- Could be either :
 - **Incomplete duplication** : both ureters join in the lower third of their course or
 - **Complete duplication** : both ureters opening separately into the bladder

- The pelvis arises from the **anterior** aspect of the kidney
- Lower pole calyces point **medially**
- The pelvi-calyceal system lies at **lower** level
- The pelvi-calyceal system is closer to the **midline**
- The ureters lie on the body of vertebrae, not on transverse processes

Ectopic kidney



Crossed renal ectopia



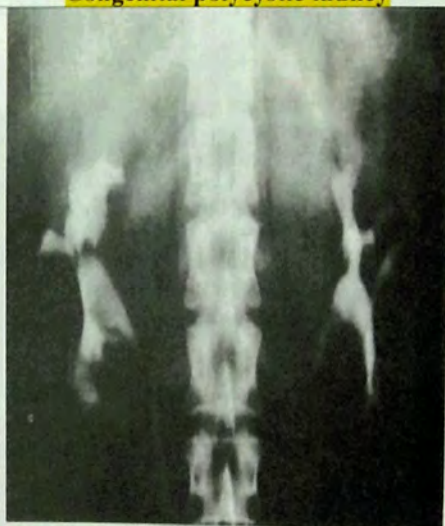
- Ectopic kidney is a **low placed kidney with straight ureter** and some calyces will face medially (malrotated)
- D.D. ptosed kidney** : a low placed kidney with tortuous ureter and all calyces are facing laterally

- Location of the kidney on the **contralateral side in respect to the ureteral orifice location at the bladder**

Renal mass



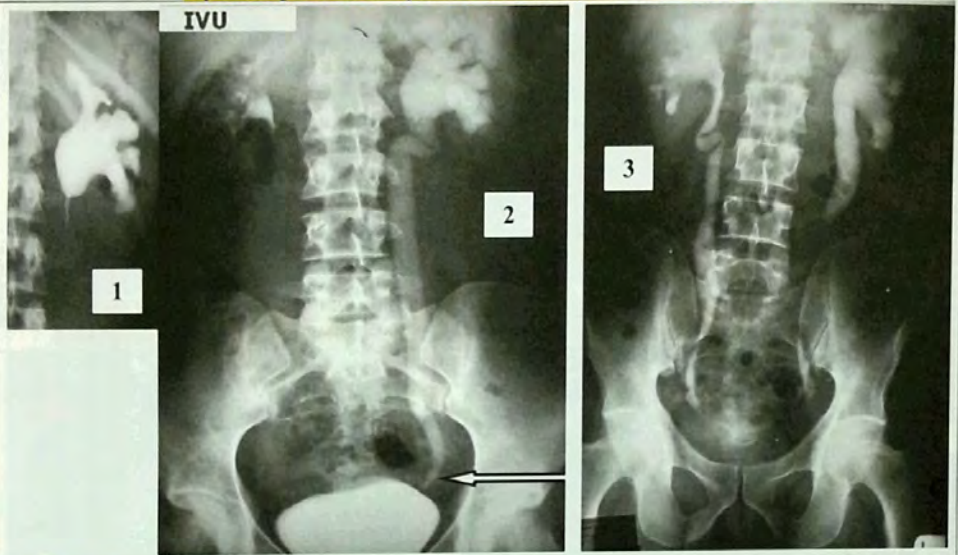
Congenital polycystic kidney



- Unilateral** displacement of pelvi-calyceal system showing **spider leg appearance or amputated pelvi-calyceal system**
- In adults : mostly hypernephroma
- In children : mostly Wilm's tumor

- The calyces are stretched over the cysts giving the **bilateral spider leg appearance; elongation, narrowing, stretch and wide separation of calyces.**

Hydronephrosis & hydroureter (unilateral or bilateral)



- **Dilated** pelvi-calyceal system & ureter
- There is **deformed** smooth curve between the lower border of lower calyx, renal pelvis and ureter
- There is loss of waist, flattening, clubbing and **ballooning of minor calyces**
- **Comment on :**
 - Unilateral or bilateral
 - Is the other kidney functioning or not .
 - Site of obstruction :
- 1. **Unilateral hydronephrosis :** pelvi-ureteric junction obstruction
- 2. **Unilateral hydronephrosis & hydroureter :** lower ureteric obstruction (stones or stricture)
- 3. **Bilateral hydronephrosis & hydroureter :** bladder neck obstruction or bilateral lower ureteric obstruction

Non- visualization of one kidney

❖ Non- visualization of one kidney for DD :

- Congenitally absent
- Surgically removed (nephrectomy)
- Non functioning
- $\pm$ reflexly inhibited by a recent attack of renal colic



VII- Cystography

Normal cystography

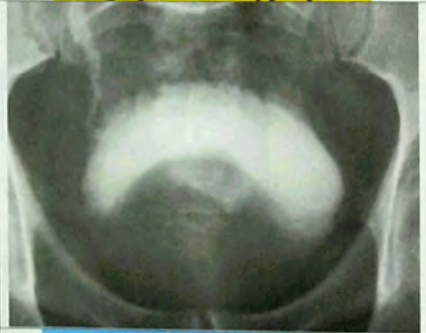


- **Types :** Descending : no urethral catheter OR Ascending : urethral catheter present

Bladder diverticulum



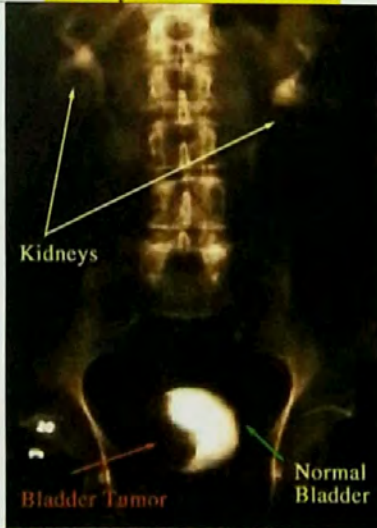
Benign prostatic hyperplasia



- The cystography will show bladder diverticulae as **out pouching of the dye**

- **Smooth basal filling defect** in the bladder raising the bladder shadow above the symphysis pubis
- There may be sacculations in the wall of the bladder or actual diverticulae
- Hydronephrotic changes of the kidneys

Urinary bladder carcinoma

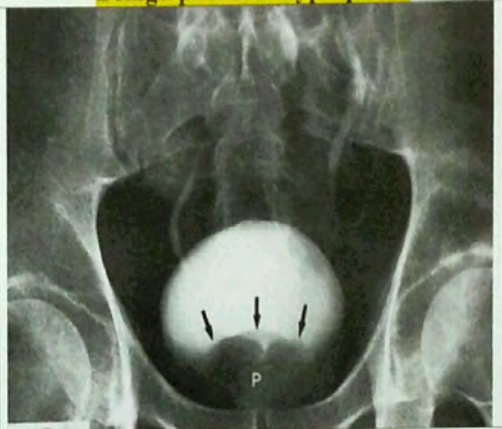


Irregular filling defects in the lateral part of UB

Bladder diverticulum



Benign prostatic hyperplasia



Urinary bladder carcinoma



BPH & bladder diverticulum

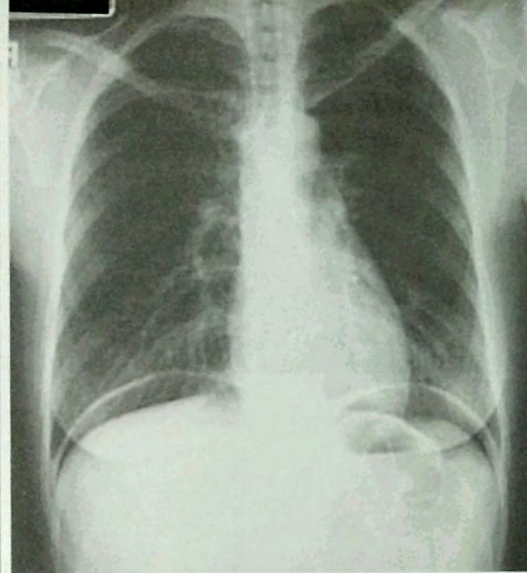


B-Plain X-Rays

I-Black shadow = air

Pneumoperitoneum , upright (erect) position

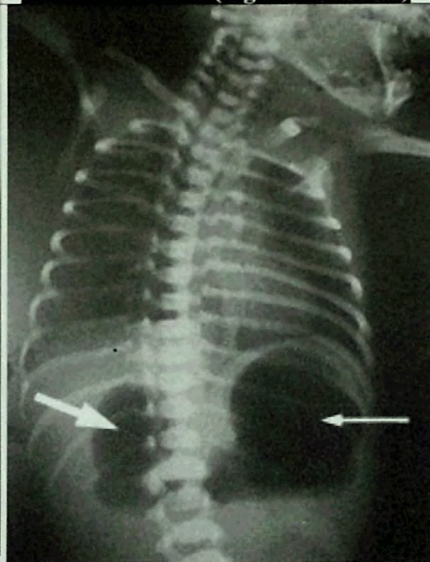
EMBBS



- Free air (hypertranslucent) in the peritoneal space under the diaphragm above the stomach on the left side and liver on the right side.
- The most common cause is perforated peptic ulcer.

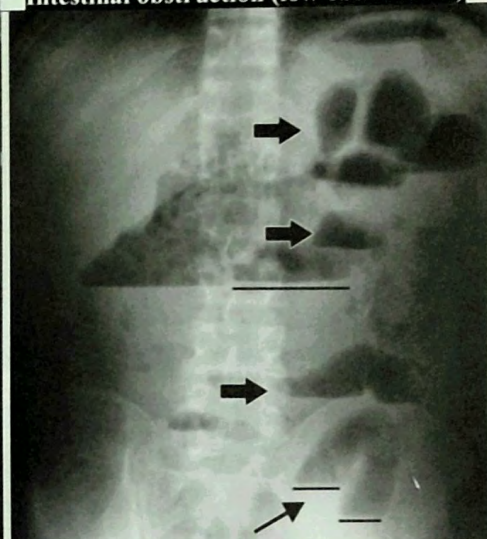
Bowel Obstruction ,upright(erect) position

Duodenal atresia (high obstruction)



- The abdomen is distended by two air and fluid levels (double bubble sign)
- No other gases are seen on the abdomen

Intestinal obstruction (low obstruction)



- The abdomen is distended by multiple gas and fluid levels
- Distended intestinal loops

Bowel Obstruction , supine position = dilatation of the bowel

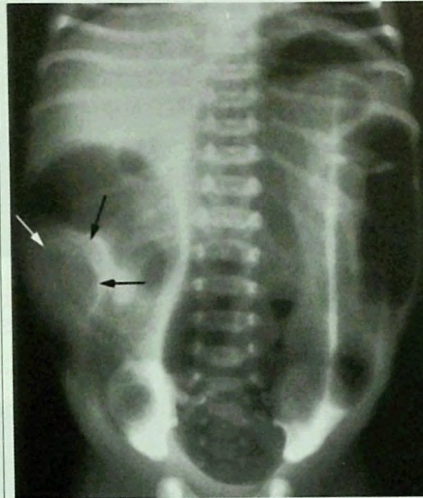
- Identification of the level of intestinal obstruction from pattern of the distended bowel loops

Small intestine obstruction at level of jejunum



- Distended jejunal loops show the characteristic circular mucosal folds (**valvulae conniventes**) **crossing** from one side of the lumen to the other and are equally spaced.

Small intestine obstruction at level of ileum



- Distended ileal loops appear as **structureless tubes** with no mucosal pattern

Large intestine obstruction



- A colon full of gas shows **hausturation** that **do not reach the other side** of the lumen,

II- Radio-opaque foreign body e.g. swallowed or surgically implanted.



III- Radio-opaque stones : describe (site, size & shape)

Kidney stone



Ureter stone



- In the right or left hypochondrium opposite T12,L1,2,3

- Oval, along tips of transverse processes of lumbar vertebrae.
- On ala of the sacrum
- On side wall of pelvis

Urinary bladder stone



- In the midline, suprapubic

Anterior urethral stone (bulbous & penile)

Posterior urethral stone (prostatic & membranous)



- Below the level of symphysis pubis
- Behind the symphysis pubis in the midline

Gall bladder stone



- Any **opaque shadow in the right hypochondrium** (Antero-Posterior view) needs lateral view to differentiate right kidney stone from gall bladder stone
- **In lateral view :**
 - Gall bladder stones → in front of the spine
 - Kidney stones → on the spine
- Only 10 % of gall bladder stones are radiopaque and the majority is radiolucent.

IV- Calcifications :

- **Organ :**

- Anatomical site

- Pattern of calcifications :

- Solid organ : mottling or dottling

- Hollow organ : linear = organ boundaries

Calcification in liver



- **Causes :** hydatid cyst , abscess , hepatoma

Calcified kidney = nephrocalcinosis



- **Causes :** TB , pyonephrosis

Calcification in spleen



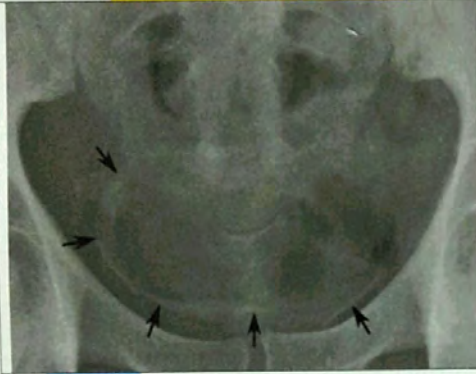
- **Causes:** Splenic infarction , hydatid cyst

Calcified pancreas



- **Cause:** chronic pancreatitis

Calcified Urinary bladder



- **Causes :** Bilharzial calcification , eaten calcification in urinary bladder (squamous cell carcinoma)

Calcified Prostate



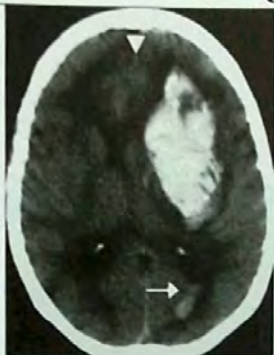
- **Causes :** Bilharzial calcification , TB

Calcified mesenteric lymph nodes= Tabes mesenterica

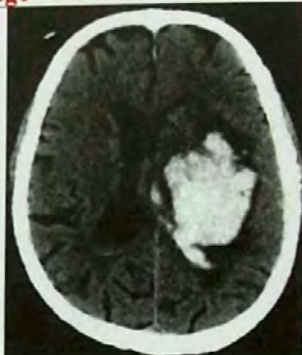


التيه يترجون بالدموع يحصدون بالابتهاح
انظروا إلى الأجيال القديمة وتأملوا. هل توكأ أحد على الرن فنخري؟
الذي بدأ معك اول الطريق له يتركة في منتصفه
هو شايف هو عارف مش ينسى ☺

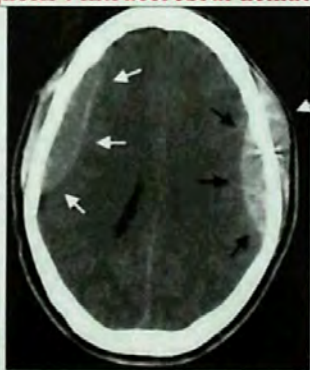
CT Scan : Hemorrhage



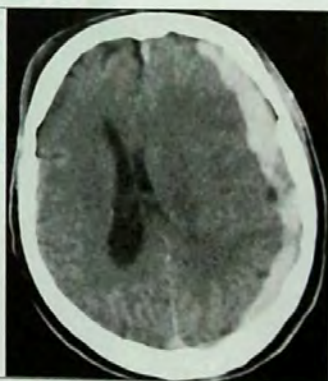
- Plain CT scan of head
- Ventricular level (lateral ventricular horns & 3rd ventricle)
- **Hyperdense lesion in the cerebral substance** in the left temporo-parietal area with mass effect (compression of the left lateral ventricle)
- There is intraventricular extension of hemorrhage (arrow)
- **Diagnosis : intracerebral hematoma**



- Plain CT scan of head
- Ventricular level (bodies of lateral ventricle)
- **Hyperdense** area affecting the left **ventricle** with ventricular dilatation
- **Diagnosis : intraventricular hematoma + acquired obstructive hydrocephalus**



- Plain CT scan of head
- Ventricular level (bodies of lateral ventricle)
- **Hyperdense biconvex** lesion affecting right fronto-parietal region (white arrow) with mass effect (compression of right ventricle)
- With left temporal fracture producing another epidural hematoma and extracranial hematoma
- **Diagnosis : epidural hematoma.**



- Plain CT scan of head
- Ventricular level (bodies of lateral ventricle)
- **Hyperdense concavo-convex lesion**, affecting left fronto-parietal region with mass effect (compression of the left lateral ventricle)
- **Diagnosis : subdural hematoma.**

CT Scan : Miscellaneous



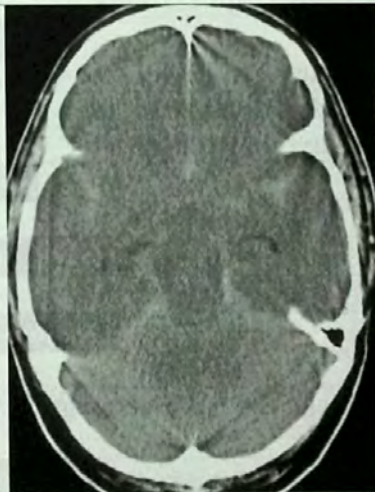
- Plain CT scan of head
- Ventricular level (bodies of lateral ventricle)
- **Hypodense** localized area in the left frontoparietal region with mass effect (compression of the left lateral ventricle) with normal right lateral ventricle.
- **Diagnosis : localized infarction in the frontoparietal region**



- **Contrast enhanced CT**
- Ventricular level (bodies of lateral ventricle)
- Small **hypodense** area with ring enhancement of abscess capsule in the left fronto-parietal region
- **Diagnosis : single small brain abscess**



- Plain CT scan of the head
- Ventricle level (bodies of lateral ventricle)
- **Increased prominence** of cerebral sulci , interhemispheric fissure, ventricular dilatation (passive dilatation due to reduced cerebral mass)
- **Diagnosis : brain atrophy**



- Plain CT scan of head
- Infratentorial level (posterior fossa)
- **Diffuse brain hypodensity** with loss of grey white interphase & loss of infratentorial spaces
- **Diagnosis : brain edema (loss of CSF spaces)**

INDEX

Clinical Pathology

Hematology

Blood	73
-------	----

Nephrology

Urine analysis	82
Kidney function tests	86
Acid – base balance	88

Hepatology

Liver function tests	90
Hepatitis markers	94

Endocrinology

Oral glucose tolerance test = DM	98
Adrenal function tests	102
Thyroid function tests	103

Neurology

CSF analysis	105
--------------	-----

Cardiology

Myocardial infarction	108
-----------------------	-----

Serology & infections

Widal test	110
Immunology e.g. Rheumatology; RA, SLE	111

Gastroenterology

Stool analysis	113
----------------	-----

BLOOD**➤ Normal blood values :**

1. Red blood cell parameters : variable according to age & sex		
Item	Value	Average
RBCs	♂ = $4.5 - 5.5 \times 10^{12} / L$ ♀ = $3.8 - 4.8 \times 10^{12} / L$ ↑ = polycythemia , ↓ = anemia	5
Hemoglobin(Hb)	♂ = 13 – 17 g/dl ♀ = 12 – 16 g/dl - Anemia = decreased Hb content	15
Colour index	- C.I = $HB\% \div RBC\% = 100 \div 100 = 1$ - C.I. < 0.9 = microcytic hypochromic anemia - C.I. = 1 = normocytic normochromic anemia - C.I. > 1.1 = macrocytic anemia - NB : CI is non-reliable as there are no absolute numbers (only%)	1
Packed cell volume (PCV) or hematocrite value	♂ = 40 – 50 % ♀ = 35 – 45 % - It is the volume of packed red cells in relation to the total volume of blood - It increases in polycythemia – dehydration - It decreases in anemia – overhydration	45 %
Mean corpuscular volume (MCV)	- Normal = 78 – 98 fl - In anemia : < 78 : microcytic anemia 78 – 98 : normocytic anemia > 98 : macrocytic anemia	90 femtoliter = Cubic micron
Mean corpuscular hemoglobin(MCH)	Normally : 27-32 pg	30
Mean corpuscular hemoglobin concentration	- Normally : 32-35 g/dl - In anemia : < 32 : hypochromic anemia 32-35 : normochromic anemia > 35 : hyperchromic anemia	34 %
Red cell distribution width	RDW = Normally : 11.5 – 14.5 %	
Reticulocytes	Normally represent 0.5-2 % of RBC concentration	

2. **Osmotic fragility**: hemolysis of RBC begins at 0.45 and ends at 0.33 gm % NaCl.

3. **Size** : diameter of RBC = 7.2 micron

- Marked variation in size = anisocytosis
- Microcyte < 6.7 micron
- Macrocyte > 8 micron
- Megalocytes > 12 micron

NB: Units :

- Milli = 10^{-3}
- Micro = 10^{-6}
- Nano = 10^{-9}
- Pico = 10^{-12}
- Femto = 10^{-15}

4. **Shape** : rounded biconcave disc

• Abnormally :

shape	Target cell	Spherocytes	Sickle cells
Causes	Anemia : - Thalassemia - Sickle cell anemia - Iron deficiency anemia	- Hereditary spherocytosis	- Sickle cell anemia
	Liver - Obstructive jaundice - Liver disease	- Autoimmune hemolytic anemia	
	After splenectomy	- Blood transfusion	
NB:	Poikilocytosis : red cells are variable in shape .		

5. **Reticulocytes** :

- RBCS development :

Normoblast (never in peripheral blood) → reticulocyte (0.5-2%) → erythrocyte (RBC)

- Normally represent 0.5-2 % of RBC concentration
- It is the cell which remains after extrusion of the nucleus from late normoblast, and it is the stage before mature red cells.
- Its percentage is a reflection of B.M. activity provided that it is corrected for anemia
- **Reticulocytosis** = ↑ reticulocyte count : hemolytic anemia , acute hemorrhage , acute hypoxia , anemia under treatment
- **Reticulocytopenia** = ↓ reticulocyte count : aplastic anemia & dyshemopoietic anemia

LEUKOCYTES

- Total count : 4000 – 11,000 /mm³
- Differential count :

Cell type	% (relative value)	Absolute value
➤ Granular Leukocytes:		
• Neutrophil (phagocytosis)	40 – 75 %	2,000 – 7,000 / cmm
• Eosinophil (histamine secretion)	1- 6 %	20 – 500 / cmm
• Basophils (heparin secretion)	< 2 %	20 – 100 / cmm
➤ Non Granular Leukocytes		
• Lymphocytes (immunity)	20 – 40 %	1,500 – 3,500 /cmm
• Monocytes (phagocytosis)	2 – 10 %	200 – 1,000 /cmm
• NB: All leucocytes (except lymphocytes) develop from bone marrow while lymphocytes develop from lymphoid tissue, therefor in any neutropenia there is lymphocytosis		

• **Neutrophils development** :

• Staff (or stab) cells → segmented cells • Normal staff : segmented ratio : 1: 5-10	
Abnormally :	
Staff : segmented < 1:5 Shift to the left :	Staff : segmented > 1: 10 Shift to the right
↑ percentage of staff above normal (5 %) in overactive BM	↑ segmentation in delayed BM
causes : in any leukocytosis	Cause : megaloblastic anemia

PLATELETS

- Normal count : 150,000 – 350,000 / mm³
- Function : hemostasis
- ↓ = Thrombocytopenia
- ↑ = Thrombocytosis

ESR

1. **Definition :** distance sedimented by RBCS in a vertical blood column at the end of 1 or 2 hours.

2. **Mechanism :**

- Normally red cells are negatively charged and repel each other
- The increase in plasma globulin, fibrinogen causes decrease in these negative charges, allowing RBC to form rouleaux & increase their sedimentation.

3. **Normal value :** Westergren's method :

	1 st hour	2 nd hour
Male	5 mm	8 mm
female	10 mm	16 mm

4. **Clinical significance :** prognostic value not diagnostic

5. **Causes of increase ESR :**

- Physiological : females during menses – pregnancy
- Pathological: TB – Malignancy – multiple myeloma - Rheumatic fever – collagen diseases.

6. **Causes of decreased ESR :** polycythemia , afibrinogenaemia , heart failure , sickle cell anemia

✓ Techniques :

- ❖ **Bleeding time :** normally 2- 7 min

- **Technique :**

- Cuff of sphygmomanometer inflated above venous (> 40 mmHg)
- Puncture hand then repeatedly dry by paper and calculate by stop watch when bleeding stops “ Test for platelet + vascular ”

- ❖ **Clotting time :** normal 5 – 10 min :

- **Technique**

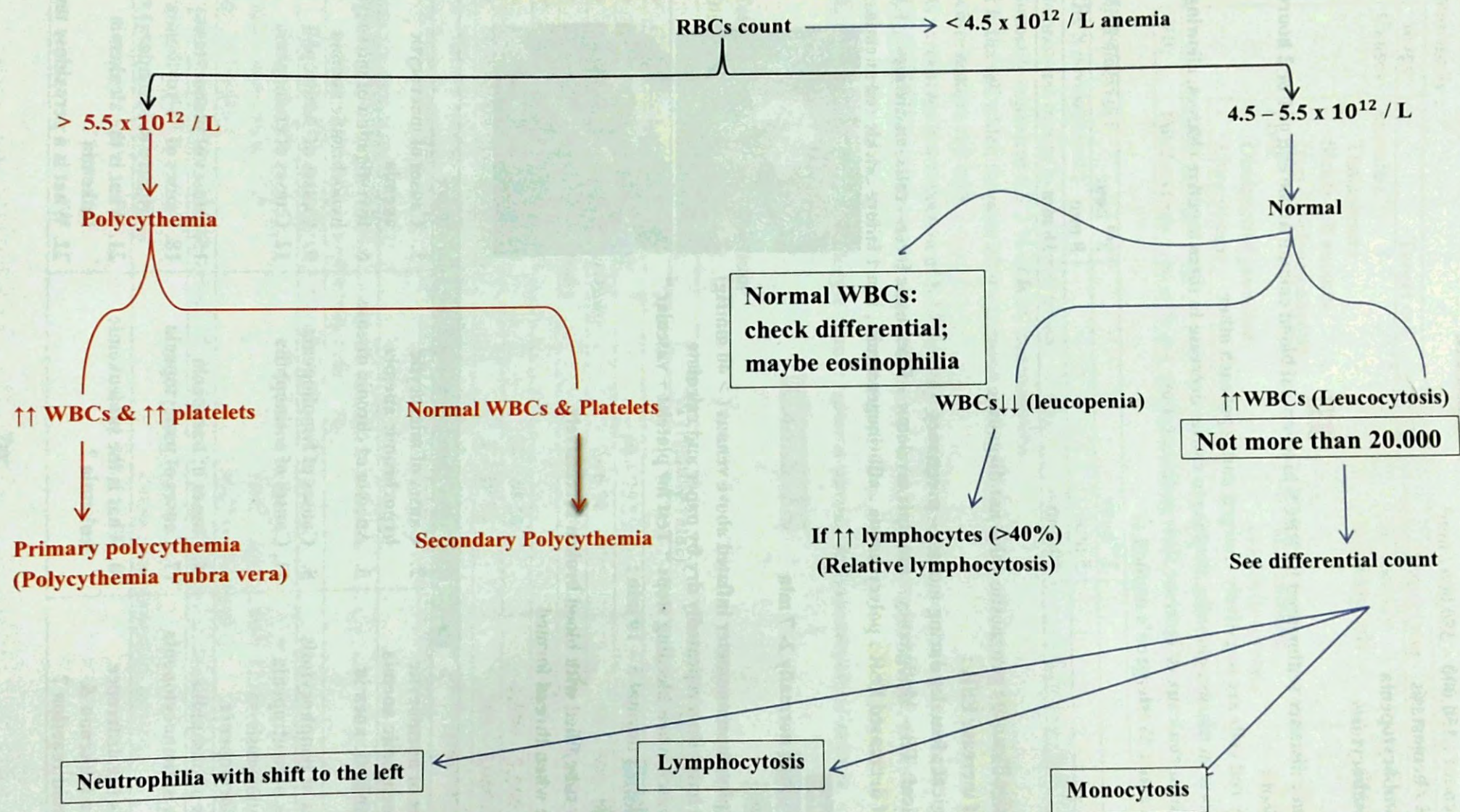
- Capillary tube filled with blood broken successively
- Calculate when thread formed



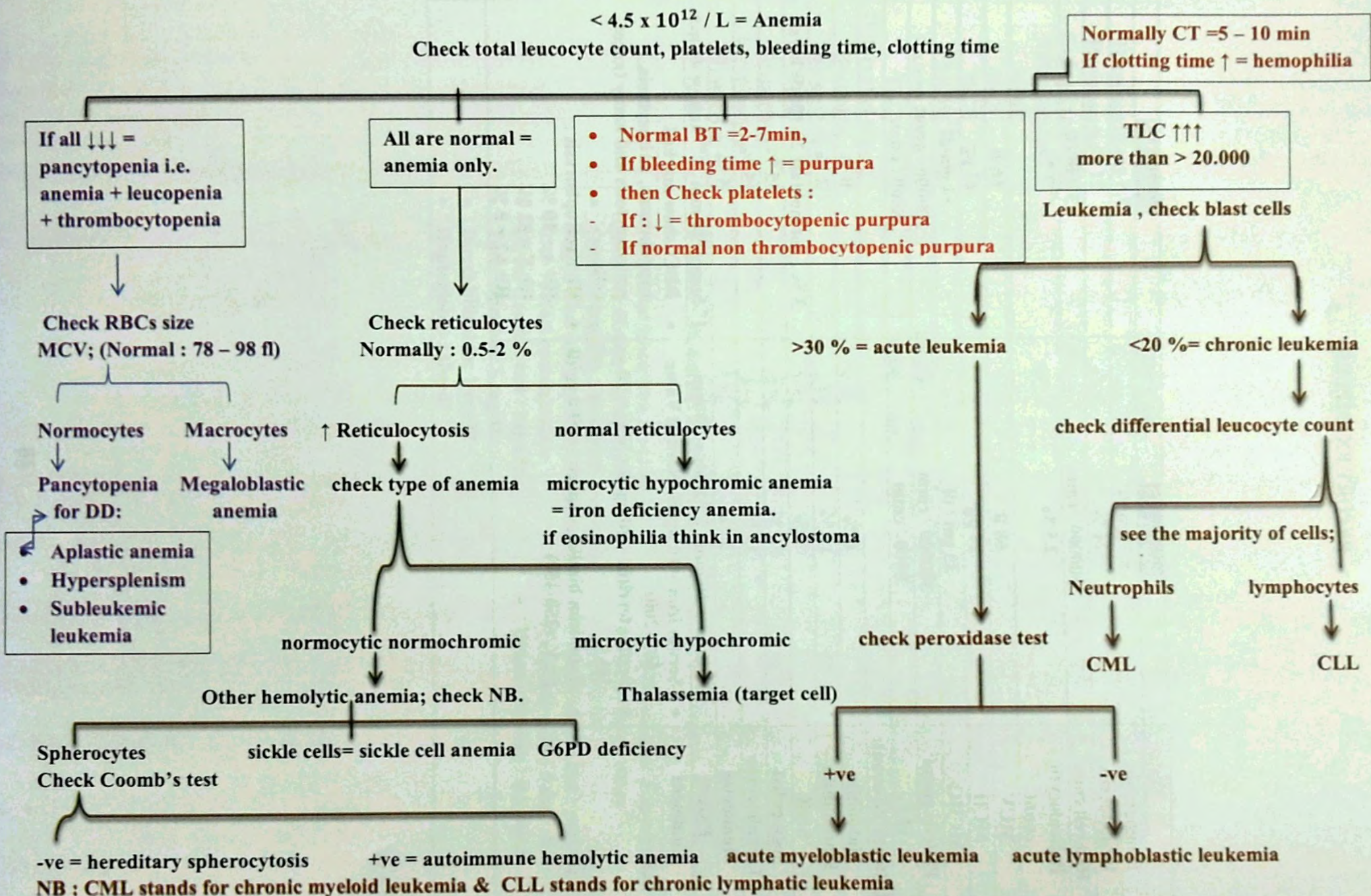
➤ Revise from your theoretical book the followings :

1. Causes of normocytic normochromic anemia	2. Causes of microcytic hypochromic anemia	3. Causes of macrocytic anemia
4. Sideroblastic anemia	5. Anemia of chronic disease	6. Investigation of microcytic hypochromic anemia
7. Causes of lymphocytosis	8. Causes of lymphopenia	9. Causes of Neutrophil
10. Causes of neutropenia = agranulocytosis = granulocytopenia	11. Causes of eosinophilia	12. Causes of esoinopenia
13. Causes of basophilia	14. Causes of basopenia	15. Causes of monocytosis
16. Causes of monocytopenia	17. Causes of pancytopenia	18. Causes of Polycythemia (Primary & secondary)
19. What is the difference between leukemia & leukomoid reaction ?	20. What is the subleukemic leukemia ?	21. What is the aleukemia leukemia ?
		22. What is a peroxidase test ?

DIAGNOSTIC PATHWAY FOR BLOOD REPORT



NB: In infectious mononucleosis, there are: lymphocytosis, monocytosis, atypical lymphocytes, +ve Monospot test, +ve Paul-Bunel test



REPORT EXAMPLES

	Example 1	Example 2
Hemoglobin	8.5 gm/dl	7.5 gm/dl
Hematocrite	24 %	21 %
Red cell count	3500000 / cmm	3200000
Reticulocytic count	2.5 %	7 %
MCV	68 fl	66 fl
MCH	24 pg	23 pg
MCHC	33 gm / dl	34 gm/dl
Platelet count	300000 / cmm	300000 / cmm
TLC	8000 / cmm	8000 / cmm
Differential count:		
Basophils	0 %	0 %
Eosinophils	12 %	2 %
Staff	3 %	3 % , normoblast 20/100 WBCs
Segmented	50 %	55 %
Lymphocytes	33 %	35 %
Monocytes	2 %	5 %
ESR	1 st hour = 20 mm , 2 nd hour = 35 mm	1 st hour = 20 mm , 2 nd hour = 40 mm
Comment	- Serum iron = 10 ug/dl (Normal Value = 50 – 200) - Serum ferritin = 10 ug/dl (N.V. = 20 - 30) - Total iron binding capacity = 500 yg/dl (N.V.=250-450)	- RBCs show marked hypochromia, anisocytosis, poikilocytosis and many target cells - Hb electrophoresis : - Hb A = 10 % - Hb F = 82 % - Hb A2 = 8 %

	Example 3	Example 4
Hemoglobin	8.5 gm/dl	9 gm/dl
Hematocrite	24 %	27.5 %
Red cell count	3100000 / cmm	3000000
Reticulocytic count	6 %	8 %
MCV	76 fl	91 fl
MCH	27 pg	30 pg
MCHC	35 gm / dl	32 gm/dl
Platelet count	400000 / cmm	350000 / cmm
TLC	10,000 / cmm	8000 / cmm
Differential count:		
Basophils	0 %	0 %
Eosinophilis	2 %	1 %
Staff	3 %	4 %
Segmented	60 %	55 %
Lymphocytes	30 %	35 %
Monocytes	5 %	5 %
ESR	1st hour = 20 mm , 2nd hour = 40 mm	1st hour = 20 mm , 2nd hour = 45 mm
Comment	- Peripheral blood film revealed the presence of many spherocytes - Osmotic fragility : hemolysis started at 0.65% Nacl concentration and ended at 0.45 % Nacl concentration - Direct Coombs test : negative - Total bilirubin: 6 mg/dl - Direct bilirubin: 1 mg/dl - Haptoglobin : absent	- Peripheral blood film revealed the presence of many spherocytes - Direct Coombs test : positive - Total bilirubin : 5 mg / dl - Direct bilirubin : 0.1 mg/dl

	Example 5	Example 6
Hemoglobin	9 gm/dl	10 gm/dl
Hematocrite	27.5 %	29 %
Red cell count	3000000 / cmm	3300000
Reticulocytic count	0.2 %	0.1 %
MCV	91 fl	87 fl
MCH	30 pg	30 pg
MCHC	32 gm / dl	34 gm/dl
Platelet count	20,000 / cmm	500000 / cmm
TLC	70,000 / cmm	200000 / cmm
Differential count:		
Basophils	0 %	5 %
Eosinophilis	0 %	2 %
Staff	1 %	10 %
Segmented	5 %	32 %
Lymphocytes	0 %	1 %
Monocytes	1 %	2 %
	Blast 93 % Peroxidase stain of blasts = negative	Blasts = 5 % Promyelocytes = 3 % Myelocytes = 25 % Juvenile = 15 %
ESR	1st hour = 70 mm , 2nd hour = 130 mm	1st hour = 70 mm , 2nd hour = 120 mm

Example 7	
Hemoglobin	11.5 gm/dl
Hematocrite	35 %
Red cell count	3800000 / cmm
Reticulocytic count	2 %
MCV	92 fl
MCH	30 pg
MCHC	33 gm / dl
Platelet count	250000 / cmm
TLC	350000 / cmm
Differential count:	
Basophils	0 %
Eosinophils	1 %
Staff	2 %
Segmented	15 %
Lymphocytes	80 %
Monocytes	2 %
ESR	1 st hour = 50 mm , 2 nd hour = 80 mm

Example Number	Answer
Example 1	Iron deficiency anemia with eosinophilia (ankylostoma)
Example 2	Hemolytic anemia (thalassemia major)
Example 3	Hemolytic anemia (hereditary spherocytosis)
Example 4	Hemolytic anemia (autoimmune hemolytic anemia)
Example 5	Acute leukemia (lymphoblastic)
Example 6	Chronic myeloid leukemia
Example 7	Chronic lymphatic leukemia

➤ The MCQs on CD are very very very important for the MCQs Exam ...!



The CD contains MCQs questions for the clinical pathology : HEMATOLOGY MCQS		
Red blood cells	From question no. 1	To question no. 17
Anemia	From question no. 18	To question no. 59
Polycythemia	From question no. 60	To question no. 61
ESR	From question no. 62	To question no. 70
Leucocytes	From question no. 71	To question no. 107
Leukemia	From question no. 108	To question no. 161
Hemostasis	From question no. 162	To question no. 187
Blood transfusion	From question no. 188	To question no. 196

➤ URINE ANALYSIS :

Normal value :		
➤ Physical properties	➤ Chemical constituents	➤ Microscopic
• Volume /day : 1-1 ½ liters	• Glucose : nil	• Epithelial cells : few
• Specific gravity : 1015 – 1025	• Acetone : nil	• RBCs: 0-5 /HPF
• Aspect : clear	• Proteins : nil or +	• WBCs (pus cells): 0-5/HPF
• Color : amber yellow	• Bilirubin (bile pigment): nil	• Ova (parasites) : nil
• Reaction (pH) : acidic : 5.5 – 6.5	• Urobilinogen : nil or normal trace	• Crystals : nil or +
		• Casts : nil or hyaline casts

Clinical points for discussion

➤ Casts :

- Definition : coagulated Tamm-Horsfall protein cast formed in tubular lumen , normally = 150 mg / day
- Significance : upper urinary tract pathology
- Causes of casturia :

1. Acellular casts	2. Cellular cast
A. Hyaline : ± normal Commonest form and found in nearly all kidney diseases	A. Epithelial cast : in acute G.N. and acute tubular necrosis
B. Fatty (lipoid) : in nephrotic syndrome	B. Granular casts : diabetic nephropathy & amyloidosis
	C. broad cast : in chronic renal failure (chronic G.N.)
	D. Red cell casts : acute G.N.
	E. White cell casts : in pyelonephritis

➤ Crystals :

1. Acidic urine :

- Ca oxalate crystals : envelop shape with hyperoxaluria
- Uric acid crystals : rhomboid shape with hyperuricosuria and acute urate nephropathy

2. Alkaline urine : triple phosphate crystals (coffin lid shape)

3. Cysteine crystals : in cystinuria

4. Sulfur crystals : with sulfadiazine antibiotic

➤ Causes of red urine :

1. Hematuria e.g. renal carcinoma , tuberculosis and bilharziasis
2. Hemoglobinuria e.g. thalassemia & G6PD deficiency
3. Myoglobinuria : crush syndrome

4. Other causes of dark urine :

- Diet : beet root
- Drugs : rifampicin – phenytoin – Adriamycin
- Diseases : obstructive jaundice – viral hepatitis
- Dies : phenolphthalein

➤ Causes of white urine :

1. Uricosuria

2. **Phosphaturia** : clears up on addition of acetic acid

3. **Pyuria** : more than 5 WBCs – HPF

➤ Causes :

- Urinary tract infection
 - Acute GN
 - Sterile pyuria : TB nephritis , antibiotic therapy , non bacterial pyouria
4. **Chyluria** : presence of fat in urine in filariasis , fat clears by addition of ether

➤ Proteinuria :

- Definition : urine protein / 24 hr > 150 mg , nephrotic proteinuria > 3.5 gm / day
- Causes : revise them from your theoretical book

➤ Polyuria :

- Definition : volume of urine more than 1.5 liter / day
- Causes : revise them from your theoretical book

➤ Oliguria :

- Definition : volume of urine less than 400 CC / day
- Causes : revise them from your theoretical book

➤ Anuria

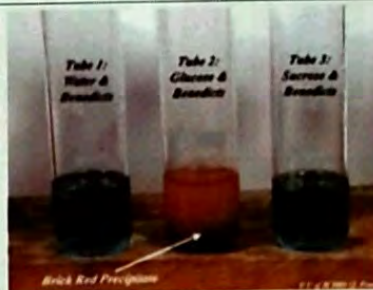
- Definition : complete absence of urine output for more than 12 – 24 hours
- Causes : revise them from your theoretical book

✓ Techniques

❖ Testing urine for glucose :

A. **Old methods** : Fehling's & Benedict's tests

- Idea : glucose is a reducing agent



- Reagent (colour) $\xrightarrow[\text{(glucose)}]{\text{reducing substance}}$ reduced reagent (another colour)

- Disadvantage : non specific
- False +ve :
 - CHO other than glucose (e.g. lactose so +ve in lactating females)
 - Non-CHO : Asprin , Ascorbic acid

B. **Recent methods** : strips has enzymes glucose oxidase

- Only react with glucose → change colour of strip ; highly specific

❖ Testing urine for proteins :

A. **Old methods** : by heating test → coagulation → either proteins or phosphate

- To DD add acetic acid ; if dissolve , so it's phosphate & if not so it 's proteins

B. **Recent methods** : by strips which is sensitive to albumin in urine

- Normal albumin trace in urine is 10 mg % (150 mg/day)
- If > 10 mg% → proteinuria → change the colour of strip



DIAGNOSTIC PATHWAY FOR URINE REPROT

Check specific gravity (SG)

**Very low SG;
< 1010 = polyuria,
Either**

- Diabetes insipidus or
- Functional DD by water deprivation test

**Low fixed SG;
1010 = Renal Failure
Either**

- Pus cells ↑ → chronic PN or
- Proteins ↑ → No Syndrome

Check	Normal SG; 1015 - 1025	High SG; > 1025
1. Aspect turbid	Either : • Aspect turbid + Pus cells ↑ (↑WBCs= white casts = pyuria) → acute PN (pyelonephritis) OR • Aspect turbid + Pus cells ↑ (WBCs) + RBCs ↑ + crystals → Crystaluria - Check type of crystals : oxalate , urate , ... etc.	
2. Proteins ↑↑↑	Nephrotic (No) syndrome (± fatty cast = lipoid cast)	
3.	• Color red + RBCs ↑↑↑ → hematuria for DD - Check ova for bilharziasis	• Aspect smoky + Red cell cast + RBCs ↑↑↑ → acute GN
4.	• Bilirubin only → obstructive jaundice • Urobilinogen only → hemolytic jaundice • Both → hepatocellular jaundice	• Glucose ± acetone → DM If there are proteins ↑↑↑ → think in diabetic nephropathy i.e. Kimmelstiel Wilson syndrome
5.		All rest of report normal → diminished water intake

NB : PN stands for pyelonephritis , No stands for Nephrotic .

REPORT EXAMPLES

Example 1	
Physical examination	
Volume	200 cc (random sample)
Colour	Amber yellow
Reaction	Acidic
Specific gravity	1025
Aspect	turbid
Chemical examination	
Albumin	++
Sugar	Nil
Acetone	Nil
Bile pigments	Nil
Uroblinogen	Norma trace
Microscopic examination	
Epithelial cells	++
Pus cells	> 100 / HPF
RBCs	2-3 / HPF
Crystals	Nil
Casts	Nil
Diagnosis	

Example 2		Example 3
Physical examination		
Volume	4000 cc/24 hrs	100 cc (random sample)
Colour	Pale yellow	Amber yellow
Reaction	Acidic	Alkaline
Specific gravity	1002	1030
Aspect	clear	turbid
Chemical examination		
Albumin	Nil	+
Sugar	Nil	++
Acetone	Nil	Nil
Bile pigments	Nil	Nil
Uroblinogen	Norma trace	Norma trace
Microscopic examination		
Epithelial cells	Nil	+
Pus cells	0-1 / HPF	15 – 20 /HPF
RBCs	0-1 / HPF	8-10 / HPF
Crystals	Nil	Amorphous phosphate (+) Triple phosphate (++)
Casts	Nil	Nil
Ova	Nil	Nil
Diagnosis		

Example number	Answer
1	Acute pyelonephritis
2	Polyuria (D.L.)
3	Crystalluria (+D.M.)

KIDNEY FUNCTION TESTS

➤ Non protein nitrogenous compounds = NPN = normal kidney function :	Diagnostic pathway in kidney profile Abnormality :
- Blood urea : 15 – 40 mg% • BUN = blood urea nitrogen = urea divided by 2.14 - Serum uric acid : 2- 7 mg % ➤ Electrolytes : - Serum K : 3.5 – 5 mg% - Serum phosphate : 2.5 – 5.5 mg% - Blood sugar : Fasting : 70 – 110 mg% 2 hrs post prandial : < 140 mg% - Serum creatinine : 0.6 – 1.4 mg % • It is the end product of creatine coming from muscles. • It's level in blood inversely related to GFR	Increase in renal failure (acute & chronic)
• NB : Creatinine clearance : - Definition : volume of blood (in ml) cleared from its creatinine content per minute - Normal Value : 125 ml /min = glomerular filtration rate; GFR - Decrease in renal failure (acute & chronic) - Better than serum creatinine as it's parallel to kidney function - Calculated from : $\frac{\text{urine creatinine} \times \text{urine volume}}{\text{plasma creatinine}} = \frac{U \times V}{P}$	
- Serum Na : 135 – 145 mEq%	• Decrease in acute renal failure • Variable in chronic renal failure (↑ or ↓)
- Serum Ca : 9 – 11 mg %	Decrease in chronic renal failure only
- Serum albumin : 4 – 6 gm %	Decrease in nephrotic syndrome
- Serum Cholesterol : 150 - 200 mg %	Increase in nephrotic syndrome

➤ Possibilities include :

1. Nephrotic syndrome with normal kidney function
2. Renal failure without nephrotic syndrome
3. Renal failure with nephrotic syndrome
4. Renal failure with renal osteodystrophy
- ↑ alkaline phosphatase
- Serum bilirubin normal to exclude liver diseases

✓ Which is better ?

❖ Blood urea or serum creatinine ? **serum creatinine**

- Blood urea is affected by many factors : dietary protein , tissue catabolism , liver functions & kidney functions
- While serum creatinine is affected by kidney functions and muscle mass which is fixed

❖ Serum creatinine or urea clearance ? **urea clearance**

- Both are good monitors of kidney functions but urea clearance is better as it determine percentage of functioning tissue of the kidney

❖ Urea clearance or creatinine clearance ? **creatinine clearance**

- Creatinine clearance is better as it is dependent on GFR which is fixed , while urea clearance is changed by change of urine volume

REPORT EXAMPLES

Example 1

Serum urea	250 mg /dl	Normal : 10 – 50
Serum creatinine	10.5 mg/dl	Normal : 0.4 – 1.4
Serum uric acid	9 mg/dl	Normal : 3.2 – 7
Serum phosphorus	7 mg/dl	Normal : 2.5 – 5
Serum calcium	7.1 mg/dl	Normal : 8.5 – 10.5
Serum Na	128 mmol/L	Normal : 135 – 145
Serum K	6 mmol/L	Normal : 3.5 – 5.2
Blood sugar	200 mg/dl	
Diagnosis		

Example 2

Serum urea	140 mg /dl	Normal : 10 – 50
Serum creatinine	3.1 mg/dl	Normal : 0.4 – 1.4
Serum cholesterol	350 mg/dl	Normal : 50 – 250
Serum total protein	6 g/dl	Normal : 6.6 – 8.6
Serum albumin	2.3 g/dl	Normal : 3.5 – 5.5
Serum Na	139 mmol/L	Normal : 135 – 145
Serum K	5.8 mmol/L	Normal : 3.5 – 5.2
Diagnosis		

Example 3

Serum urea	50 mg /dl	Normal : 10 – 50
Serum creatinine	1.2 mg/dl	Normal : 0.4 – 1.4
Serum cholesterol	350 mg/dl	Normal : 50 – 250
Serum total protein	6 g/dl	Normal : 6.6 – 8.6
Serum albumin	2.3 g/dl	Normal : 3.5 – 5.5
Serum Na	139 mmol/L	Normal : 135 – 145
Serum K	5 mmol/L	Normal : 3.5 – 5.2
Diagnosis		

Example number	Answer
1	Chronic renal failure
2	Nephrotic syndrome with CRF
3	Nephrotic syndrome

ACID – BASE BALANCE

➤ Comment on the following :

➤ State of acid base balance , normal values :

- pH = 7.35 – 7.45
- ↑ = alkaline , ↓ = acidic
- Serum bicarbonate (HCO_3) : 21 – 28 mmol/L
- Blood CO_2 : 35 – 45 mmHG

Diagnostic pathway

Look at PH value

Decreased = Acidosis

Increased = alkalosis

Look at bicarbonate (HCO_3) and CO_2 level

Low HCO_3 only =
uncompensated
metabolic acidosis

Low HCO_3 &
low Pco_2 =
compensated
metabolic acidosis

High HCO_3 only =
uncompensated
metabolic alkalosis

High HCO_3 &
high Pco_2 =
compensated
metabolic alkalosis

High Pco_2 only =
uncompensated
respiratory acidosis

High Pco_2 &
high HCO_3
compensated
respiratory acidosis

Low Pco_2 only =
uncompensated
respiratory alkalosis

Low Pco_2 &
low HCO_3 =
compensated
respiratory alkalosis

Mixed metabolic and
respiratory acidosis =

- Marked decrease of pH
- Near normal Pco_2
- Near normal HCO_3

REPORT EXAMPLES

Example	1	2	3	4	5	6	7	8
Pco2	23 mmHg	27	20	65	60	68	24	42
pH	7.21	7.22	7.20	7.21	7.22	7.19	7.52	7.1
HC03	11 mEq/L	12	12	29	30	27	20	20
Diagnosis								

Example	Answer
1	Compensated Metabolic acidosis
2	Compensated Metabolic acidosis
3	Compensated Metabolic acidosis
4	Compensated Respiratory acidosis
5	Compensated Respiratory acidosis
6	Uncompensated Respiratory acidosis
7	Compensated Respiratory alkalosis
8	Mixed metabolic and respiratory acidosis

➤ Revise from your theoretical book the following :

- Causes of acidosis (respiratory & metabolic)
- Causes of alkalosis (respiratory & metabolic)



The CD contains MCQs questions for the clinical pathology : NEPHROLOGY MCQS		
Renal diseases	From question no. 197	To question no. 222
Calcium & phosphorus	From question no. 223	To question no. 230
Sodium & potassium	From question no. 231	To question no. 235
Acid – base balance	From question no. 236	To question no. 240

LIVER FUNCTION TESTS

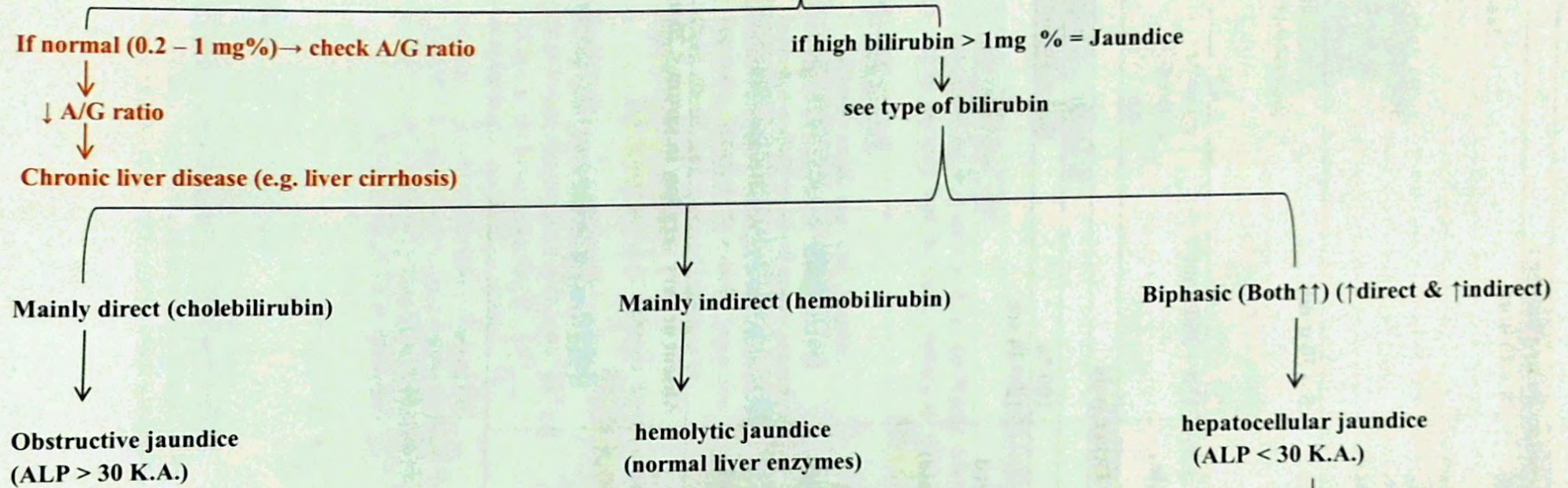
Normal :

Item	Normal value															
Protein metabolism																
1- Total protein	7 – 9 gm %															
2- Albumin	4 – 5 gm %															
3- Globulin	2 – 3 gm %															
4- A/G ratio	2:1															
Abnormality : <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th></th><th>Acute liver disease</th><th>Chronic liver disease</th></tr> </thead> <tbody> <tr> <td>e.g.</td><td>Viral hepatitis</td><td>Liver cirrhosis</td></tr> <tr> <td>Albumin</td><td>Not affected (Long life span)</td><td>↓</td></tr> <tr> <td>Globulin</td><td>↑</td><td>↑</td></tr> <tr> <td>A/G ration</td><td>Normal</td><td>Decreased or even reversed.</td></tr> </tbody> </table>			Acute liver disease	Chronic liver disease	e.g.	Viral hepatitis	Liver cirrhosis	Albumin	Not affected (Long life span)	↓	Globulin	↑	↑	A/G ration	Normal	Decreased or even reversed.
	Acute liver disease	Chronic liver disease														
e.g.	Viral hepatitis	Liver cirrhosis														
Albumin	Not affected (Long life span)	↓														
Globulin	↑	↑														
A/G ration	Normal	Decreased or even reversed.														
Fat metabolism																
1- Serum cholesterol	150 – 200 mg %															
2- Phospholipids	150 – 250 mg %															
Carbohydrate metabolism																
1- Glucose tolerance test	See detail later															
2- Lag storage curve is seen in liver cirrhosis, where there is rapid rise of blood glucose, peak is higher than normal, but the curve return to normal in less than 2 hours																
Bile pigments																
1- Total bilirubin	0.2 – 1 mg%															
It increases in all types of jaundice.																
2- Direct (cholebilirubin - conjugated)	0.2 mg %															
Increase mainly in obstructive jaundice																
3- Indirect (hemobilirubin – unconjugated)	0.8 mg%															
- Increase mainly in hemolytic jaundice - Both direct and indirect increase in hepatocellular jaundice																
Bile salts: normally absent from urine. They present in obstructive jaundice																
Biliary patency enzymes																
1- Serum alkaline phosphatase (ALP) : - It increase in both liver and bone disease - In hepatocellular jaundice : it is between 3 - 30 K.A. units - If it is > 30 units it is either obstructive jaundice or space occupying lesion in liver ➤ How to confirm that increased ALP is due to liver disease & not bone disease : - Associated increase in GGT - Associated increased in 5- nucleotidase - Abdominal ultrasonography	3 – 13 K.A. units (King-Armstrong unit) Or 30 – 130 IU/L															
2- Serum 5-nucleotidase : It increases in obstructive jaundice	1.5 IU/L															
3- Gamma glutamyl transpeptidase (GGT) : It increases in both obstructive jaundice & hepatocellular jaundice (the most sensitive)	30 IU/l															

Test for hepatocellular damage :	
1- Serum glutamic oxaloacetic transaminase (SGOT) = Aspartate transaminase (AST) : It is non-specific , increase in liver diseases especially chronic forms , heart , kidney, muscles diseases e.g. active liver damage, acute myocardial infarction , acute kidney affection , severe cases of myopathy.	8 – 40 u/ml
2- Serum glutamic pyruvic transaminase (SGPT) = Alanine transaminase (ALT) : It is specific for liver diseases especially acute forms e.g. viral hepatitis	5 – 30 u/ml
3- Lactic dehydrogenase (LDH) : Non-specific : it increases in liver , muscle , cardiac and renal diseases.	150 – 360 u/ml
Other tests	
1- Prothrombin :	
Prothrombin concentration	100 %
Prothrombin time (PT): - Best expressed as international normalized ratio “INR” - PT is prolonged (& concentration decrease) in both hepatocellular & obstructive jaundice - They are differentiated by vitamin K IM which improves PT in obstructive jaundice only. - PT is prolonged also in : mal-absorption , oral-anticoagulant use & prolonged use of antibiotics	12 – 14 sec
2- Alpha-feto protein : - Moderate elevation (20 – 500 ng/ml) : in - Hepatitis & cirrhosis - Pancreatitis - Malignancy : GIT, ovary , testis - Marked elevation (> 500 ng/ml) - Hepatocellular carcinoma	Absent or very very low in serum < 20 ng/ml

Diagnostic pathway for liver :

See bilirubin :



Check	Acute liver disease	Chronic liver disease
Albumin	Normal	↓
A/G ratio	Normal (2:1)	↓ (1:2) or reversed
PC	Normal	↓
e.g.	Viral hepatitis	Liver cirrhosis

Report Examples of liver profiles

Example 1	
Total bilirubin	3.2 mg/dl (Normal 0.1 – 1)
Direct bilirubin	1.2 mg/dl (Normal : 0 - 0.25)
AST	1250 U/L (Normal : 0 - 32)
ALT	1550 U/L (Normal : 0 - 31)
Alkaline phosphatase protein	390 U/L (Normal : 79 : 240)
Total protein	7 g/dl (Normal : 6.6 8.6)
Albumin	3.8 g/dl (Normal 3.5 – 5.5)
Diagnosis	

Example 2	
Total bilirubin	5.1 mg/dl (Normal 0.1 – 1)
Direct bilirubin	0.3 mg/dl (Normal : 0 - 0.25)
AST	25 U/L (Normal : 0 - 32)
ALT	18 U/L (Normal : 0 - 31)
Alkaline phosphatase protein	211 U/L (Normal : 79 : 240)
Total protein	7.5 g/dl (Normal : 6.6 8.6)
Albumin	5 g/dl (Normal 3.5 – 5.5)
Diagnosis	

Example 3	
Total bilirubin	0.88 mg/dl (Normal 0.1 – 1)
Direct bilirubin	0.35 mg/dl (Normal : 0 - 0.25)
AST	95 U/L (Normal : 0 - 32)
ALT	57 U/L (Normal : 0 - 31)
Alkaline phosphatase protein	287 U/L (Normal : 79 : 240)
Total protein	7.4 g/dl (Normal : 6.6 8.6)
Albumin	2.9 g/dl (Normal 3.5 – 5.5)
A/G ratio	0.6 (Normal : 1.1 – 2.5)
Diagnosis	

Example 4	
Total bilirubin	17.1 mg/dl (Normal 0.1 – 1)
Direct bilirubin	15.6 mg/dl (Normal : 0 - 0.25)
AST	70 U/L (Normal : 0 - 32)
ALT	100 U/L (Normal : 0 - 31)
Alkaline phosphatase protein	1200 U/L (Normal : 79 : 240)
Albumin	3.5 g/dl (Normal 3.5 – 5.5)
Diagnosis	

Example number	Answer
1	Acute hepatocellular jaundice
2	Hemolytic jaundice
3	Liver cirrhosis
4	Obstructive jaundice

Serology of viral hepatitis

Hepatitis A,D,E markers

Hepatitis	Acute stage	Chronic stage
Hepatitis A	Anti -HAV- IgM	Anti -HAV- IgG
Hepatitis D	Anti -HDV- IgM	Anti -HDV- IgG
Hepatitis E	Anti -HEV- IgM	Anti -HEV- IgG

Hepatitis C markers

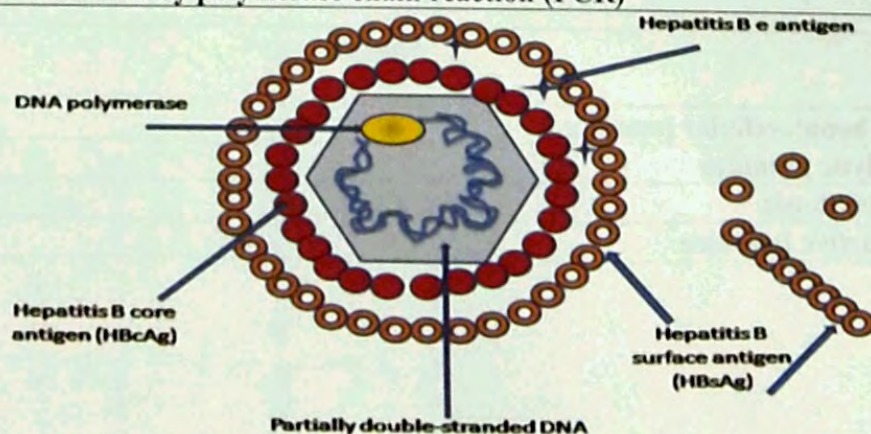
Marker	Technique	Time	Significance
HCV -Ab	3rd generation ELISA and confirmed by RIBA	After 3 – 6 months of infection	Exposure to infection , not immunity
HCV – Viral RNA	PCR Recently quantitative PCR to monitor effect of interferon treatment	After 1 – 2 weeks	Indicate active virus

- NB :

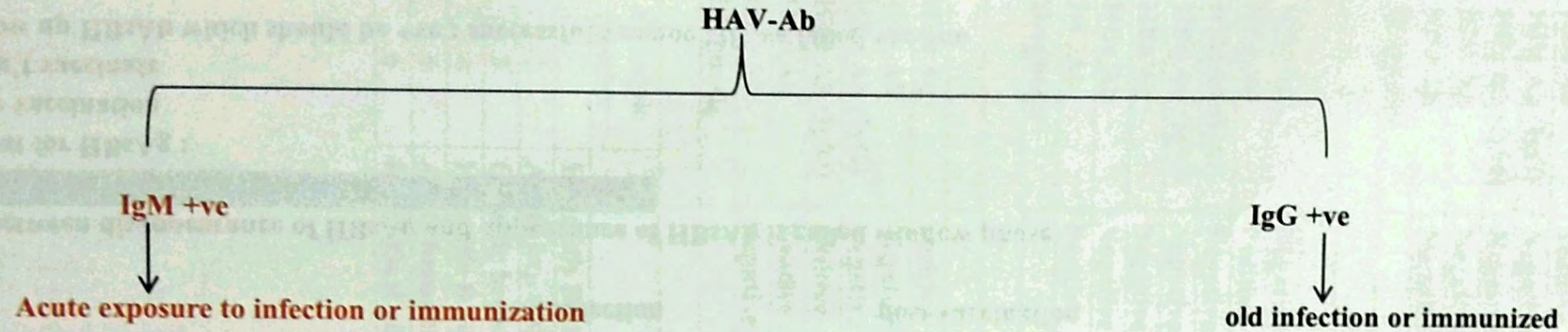
- ELISA = Enzyme-linked immunosorbent assay
- RIBA = recombinant immunoblot assay

Hepatitis B markers

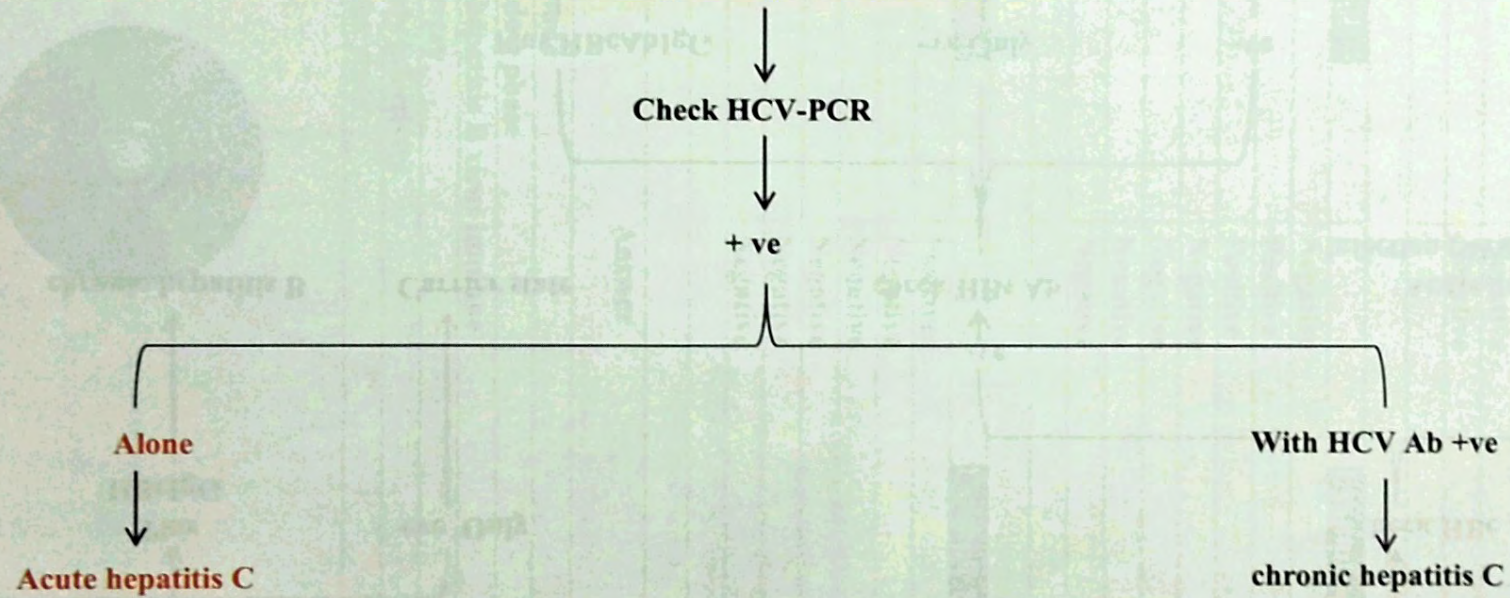
Antigen	Significance	Antibody	Significance
HBsAg (surface)	- Appear after 6 week - Acute infection if remains for 3 months - Chronic infection or carrier if more than 6 months	HBsAb = Anti-HBs	- Appear after 3 months - Reflect : - Past infection & natural immunity (if with HBcAb) - Post vaccination (if alone)
HBcAg (core)	Detected only in liver biopsy(not in serum)	HBcAb= Anti-HBc	- Appear after 2 months - Reflect : - HBcAbIgM : recent infection - HBcAbIgG : recovery (past infection) (if with HBsAb)
HBeAg (envelop)	Reflect viral replication (chronicity; high infectivity)	HBeAb = Anti-HBe	- Appear after 2.5 months - Reflect non replicating virus; good prognosis
Hepatitis B viral DNA	• Most sensitive index for viral replication & chronicity called Dane particle • Detected by polymerase chain reaction (PCR)		



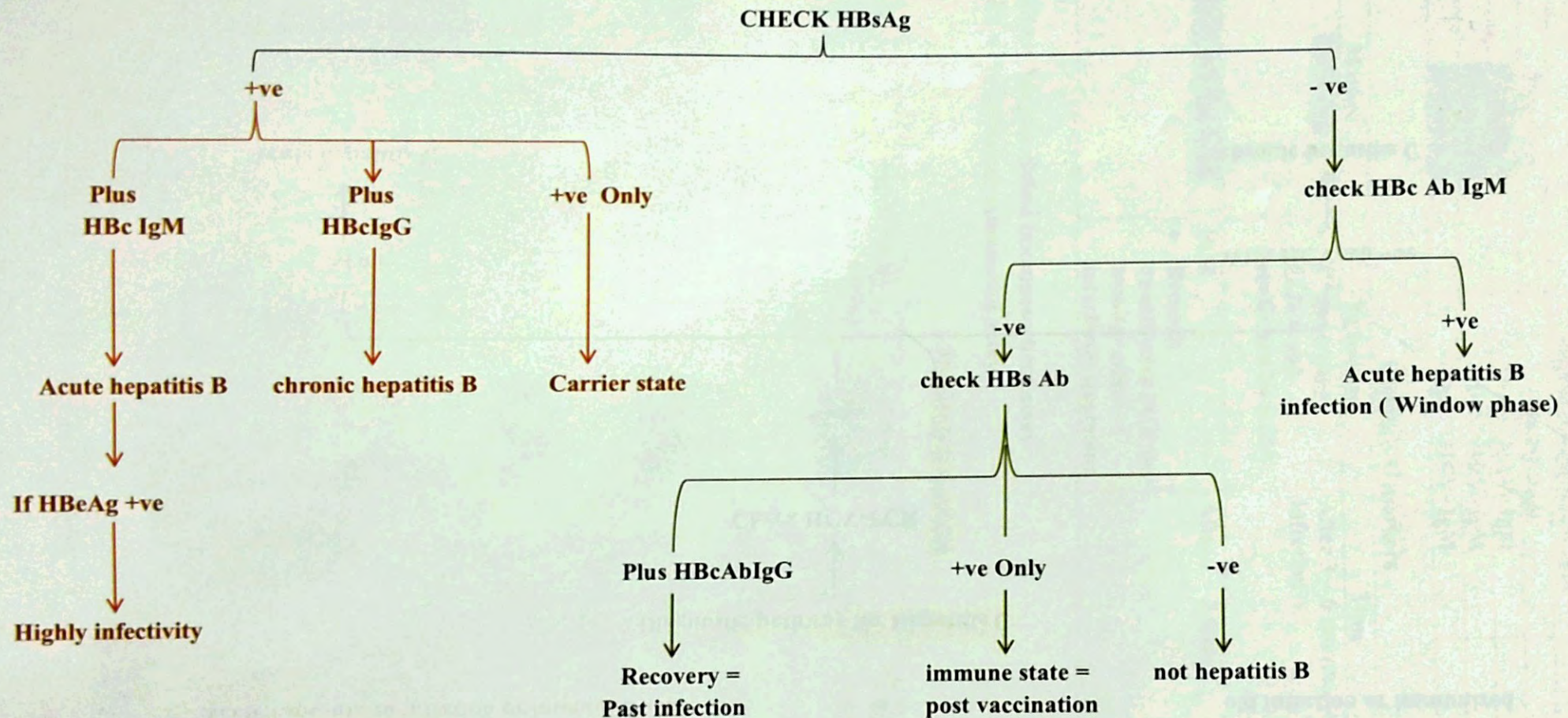
Diagnostic pathway for Hepatitis A



Diagnostic pathway for Hepatitis C



Diagnostic pathway for Hepatitis B



NB :

- The period between disappearance of HBsAg and appearance of HBsAb is called window phase
- Patient willing to have vaccine against HBV, what do you ask ?
 - Before : test for HBsAg :
 - If -ve → give vaccination
 - If +ve → don't vaccinate
 - After, follow up HBsAb which should be +ve : successful vaccine, if -ve failed vaccine

Report Examples of hepatitis markers

	Example 1	Example 2
HBs Ag	Negative	Negative
HBs Ab	Positive	Negative
HBc Ab (IgG)	Negative	Positive
HBc Ab (IgM)	Negative	Positive
HBe Ag	Negative	Negative
HBe Ab	Negative	Negative
Diagnosis		

	Example 3	Example 4
HBs Ag	Negative	Negative
HBs Ab	Positive	Positive
HBc Ab (IgG)	Negative	Positive
HBc Ab (IgM)	Negative	Negative
HBe Ag	Negative	Negative
HBe Ab	Negative	Negative
HC/Ab	Positive	Negative
Diagnosis		

	Example 5	Example 6
HBs Ag	Positive	Positive
HBs Ab	Negative	Negative
HBc Ab (IgG)	Negative	Negative
HBc Ab (IgM)	Positive	Negative
HBe Ag	Positive	Negative
HBe Ab	Negative	Negative
Diagnosis		

Example number	Answer
1	Hepatitis B virus, immune
2	Acute hepatitis B, window phase
3	Chronic hepatitis C – hepatitis B virus immune
4	Hepatitis B virus, recovery
5	Acute hepatitis B, highly infectivity
6	Hepatitis B virus, carrier state



The CD contains MCQs questions for the clinical pathology : HEPATOLOGY MCQS

Liver function tests	From question no. 241	To question no. 252
Hepatitis markers	From question no. 253	To question no. 266

ORAL GLUCOSE TOLERANCE TEST

> Indications :

1. Impaired glucose tolerance or impaired fasting glucose
2. Gestational DM
3. Patients with high risk of development of DM
4. Evaluation of unexplained nephropathy , neuropathy or retinopathy
5. Identification of persons with renal or alimentary glucosuria

> Technique :

1. Before test :

- 1 week before the test , Stop all drugs affecting blood glucose level
- 3 days before the test , normal free diet “ free carbohydrate diet “
- 1 day before the test : Patient is fasting (10 hour – 16 hours fasting)

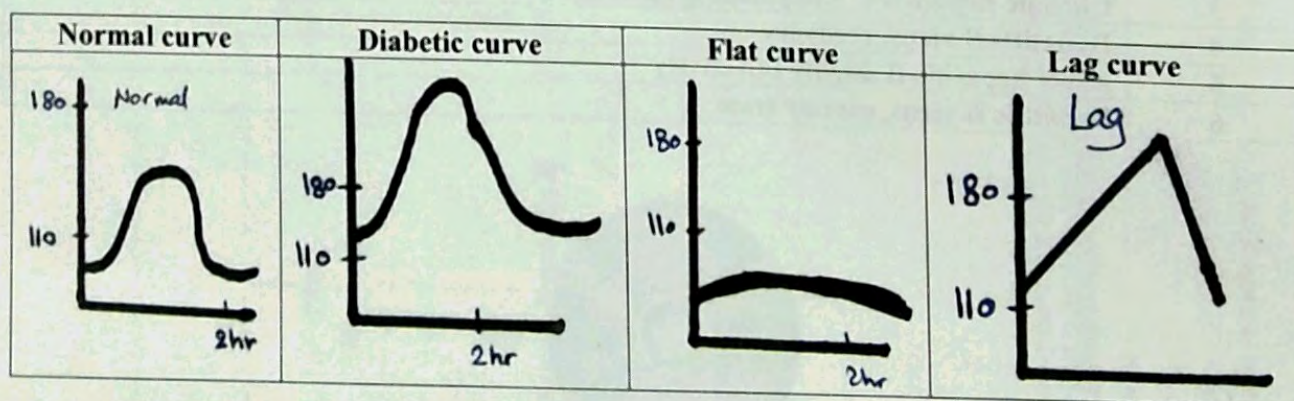
2. Test :

- The test done in the morning and should start between 7 – 9 am
- Take a sample (blood & urine) , while the patient is fasting ,
- Give the patient Oral glucose : 1 g/kg body weight (maximum 75 g) “ 75 gram glucose test”
- During test the patient should be :
 - Complete physical & mental rest
 - No eating or smoking during the test
 - Seated or lying on right side to promote emptying of the stomach
- Every ½ hour blood & urine samples are taken for 2 hours
 - Blood is tested for glucose
 - Urine is tested for glucose and acetone

> Definitions & Blood sugar curves :

- Normal blood glucose : see below
- D.M : see below
- Impaired glucose tolerance : see below
- Impaired fasting glucose : see below

❖ Types of curves :



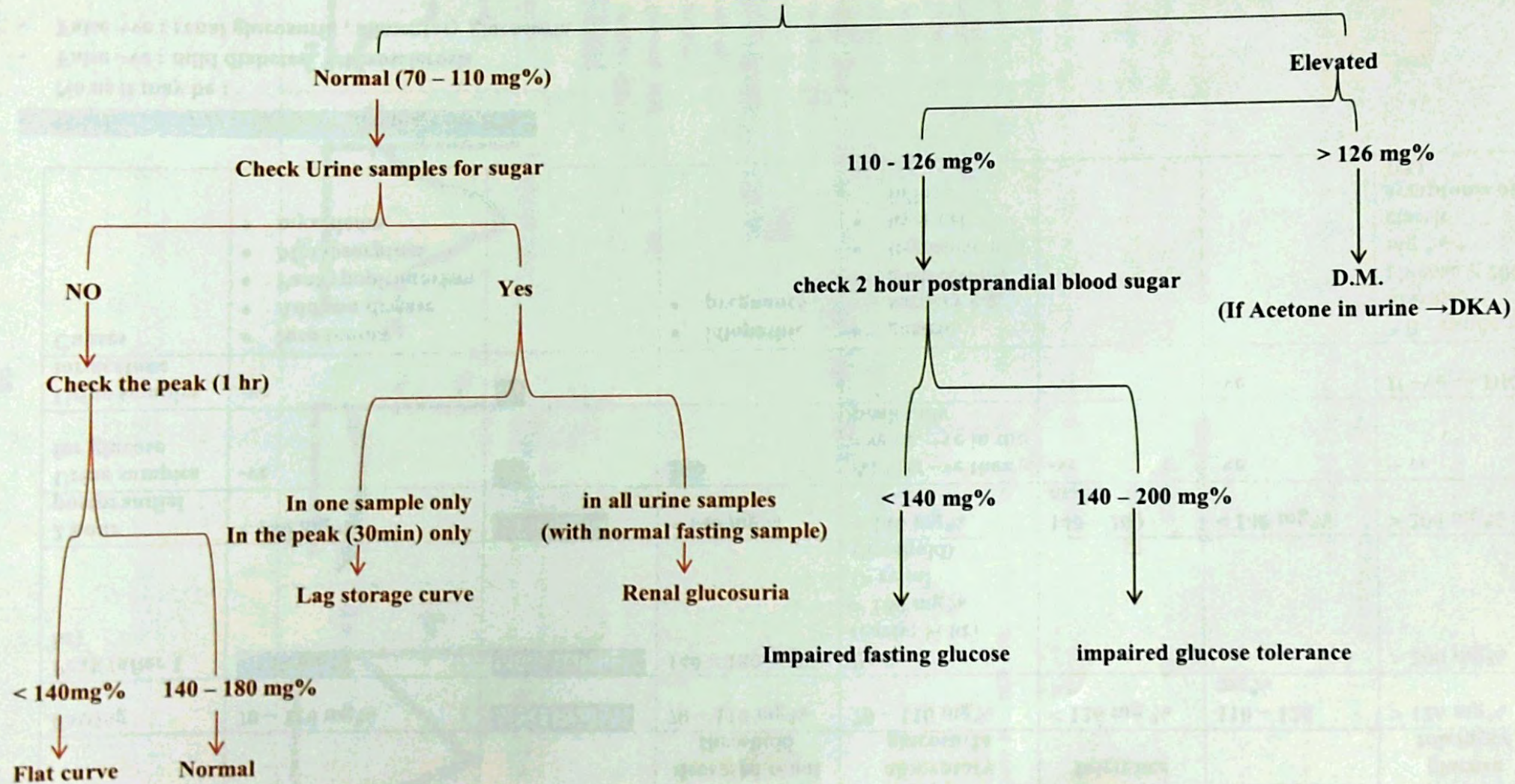
	Flat curve = increased glucose tolerance	Normal	Renal glucosuria = decreased renal threshold	Lag storage curve = alimentary glucosuria	Impaired glucose tolerance	Impaired fasting glucose	D.M. curve = decreased glucose tolerance
Fasting	70 – 110 mg%	70 – 110 mg%	70 – 110 mg%	70 – 110 mg%	< 126 mg %	110 – 126 mg%	> 126 mg%
Peak (after 1 hr)	< 140 mg%	140 – 180 mg%	140 – 180 mg%	Peak (early; ½ hr) > 180 mg% (> renal threshold)			> 200 mg%
2 hour postprandial	< 140 mg%	< 140 mg%	< 140 mg%	< 140 mg%	140 – 200 mg%	< 140 mg%	> 200 mg%
Urine samples for glucose	-ve	-ve	+ve	At first -ve then +ve i.e. +ve in the peak only	-ve	-ve	+ ve
Urine samples for acetone	-ve	-ve			-ve	-ve	If +ve → DKA
Causes	- Insulinoma - Addison disease - Panhypopituitarism - Malabsorption - myxedema		- idiopathic - pregnancy	- gastric surgery e.g. gastrectomy - thyrotoxicosis - liver cell failure			NB : random plasma glucose ≥ 200 mg % + classic symptoms of DM

• Is urine analysis reliable for diagnosis for DM ?

No as it may be :

- False -ve : mild diabetes , atherosclerosis
- False +ve : renal glucosuria , alimentary glucosuria

Diagnostic pathway for DM
Check fasting plasma glucose level



Report Examples :

Example 1			
	Blood	Urine	
		Sugar	Ketone
Fasting blood sugar	200 mg/dl	+	Nil
30 min	280 mg/dl	++	Nil
60 min	310 mg/dl	++	Nil
90 min	450 mg/dl	+++	+
120 min	500 mg/dl	++++	+
Diagnosis			

Example 2			
	Blood	Urine	
		Sugar	Ketone
Fasting blood sugar	90 mg/dl	Nil	Nil
30 min	110 mg/dl	+	Nil
60 min	160 mg/dl	+	Nil
90 min	140 mg/dl	+	Nil
120 min	100 mg/dl	+	Nil
Diagnosis			

Example 3			
	Blood	Urine	
		Sugar	Ketone
Fasting blood sugar	90 mg/dl	Nil	Nil
30 min	100 mg/dl	Nil	Nil
60 min	120 mg/dl	Nil	Nil
90 min	95 mg/dl	Nil	Nil
120 min	80 mg/dl	Nil	Nil
Diagnosis			

Example 3			
	Blood	Urine	
		Sugar	Ketone
Fasting blood sugar	90 mg/dl	Nil	Nil
30 min	100 mg/dl	Nil	Nil
60 min	120 mg/dl	Nil	Nil
90 min	95 mg/dl	Nil	Nil
120 min	80 mg/dl	Nil	Nil
Diagnosis			

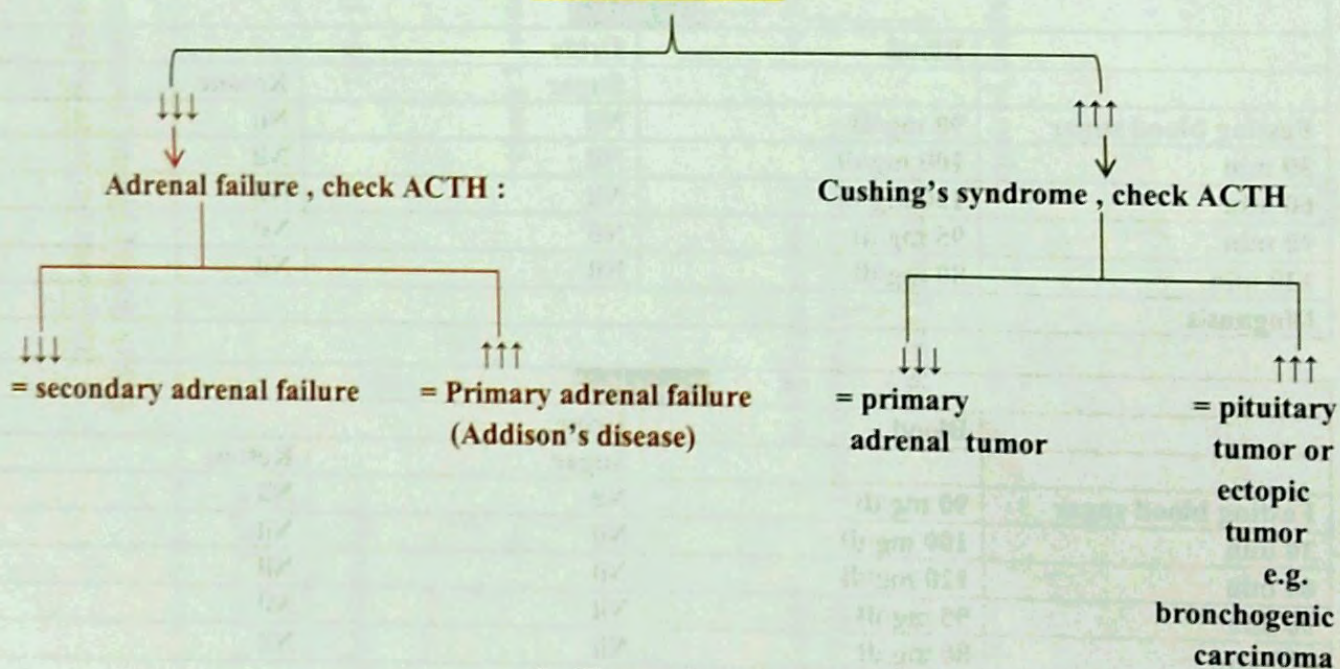
Example 4			
	Blood	Urine	
		Sugar	Ketone
Fasting blood sugar	80 mg/dl	Nil	Nil
30 min	200 mg/dl	+	Nil
60 min	80 mg/dl	Nil	Nil
90 min	50 mg/dl	Nil	Nil
120 min	90 mg/dl	Nil	Nil
Diagnosis			

Example 5			
	Blood	Urine	
		Sugar	Ketone
Fasting blood sugar	130 mg/dl	Nil	Nil
30 min	180 mg/dl	Nil	Nil
60 min	170 mg/dl	Nil	Nil
90 min	170 mg/dl	Nil	Nil
120 min	150 mg/dl	Nil	Nil
Diagnosis			

Example number	Answer
1	Sever D.M (DKA)
2	Renal glucosuria
3	Flat curve
4	Lag curve
5	Impaired glucose tolerance

❖ Adrenal function test

Check cortisol level



❖ Thyroid function test

	Normal
TSH	2- 10 units
T4	5 – 12 µg%
T3	115 – 190 nanogram %
Cholesterol	150 – 250 mg %

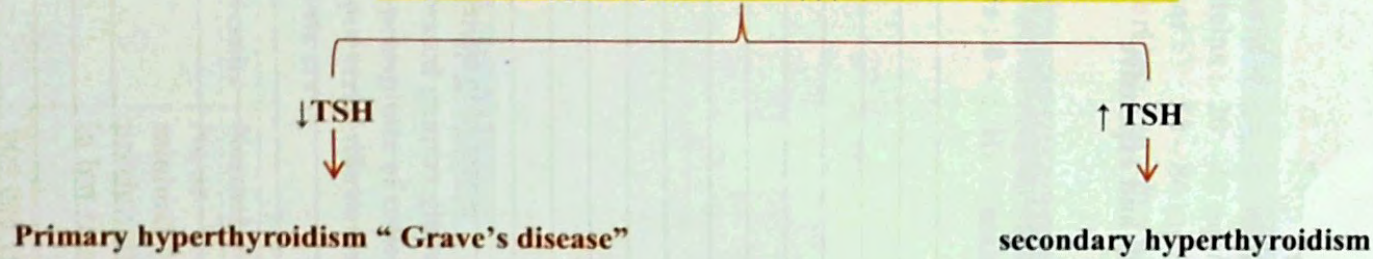


The CD contains MCQs questions for the clinical pathology : **ENDOCRINOLOGY MCQS**

Oral glucose tolerance test	From question no. 267	To question no. 276
Thyroid function test	From question no. 277	To question no. 286

Diagnostic pathway for thyroid profile:

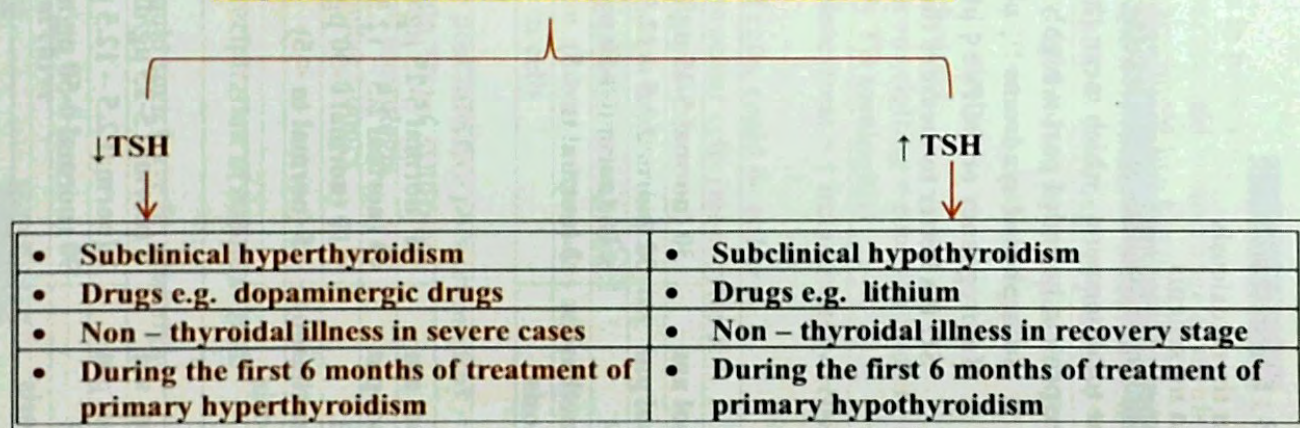
Suspected Hyperthyroidism = $\uparrow\uparrow\uparrow$ T3 & T4 , check TSH :



Suspected Hypothyroidism = $\downarrow\downarrow\downarrow$ T3 & T4 , check TSH :



Suspected Euthyroid = normal T3 & T4, check TSH :



Report examples
Thyroid function tests

	Example 1	Example 2	Example 3	Normal value
FT3	0.4 pg/dl	0.5 pg/dl	6.7 pg/dl	1.3-5
FT4	0.2 pg/dl	0.2 pg/	4.9 pg/dl	0.8-2
TSH	> 75 uIU/ml	> 50	< 0.01 uIU/ml	0.3-5
Diagnosis				

❖ NB : **Cholesterol level :**

- ↓ in thyrotoxicosis
- ↑ in myxedema

❖ **Which is better, measuring total or free part of thyroid hormone ? Free**

- The total hormone , which mean the free part & the protein bounded part
 - The protein bounded part is highly affected by the level of plasma proteins :
 - In nephrotic syndrome : ↓ plasma proteins : false myxedema
 - In pregnancy or OCPs : ↑ plasma proteins : false thyrotoxicosis
- SO it's better to measure the free part of T3 & T4 which is difficult and expensive

Adrenal function tests

	Example 1
Cortisol am	30 (normal 5-25 µg/dl)
Cortisol pm	32 (normal 2.5 – 12.5 µg/dl)
ACTH	< 10 (normal 0-50 pg/ml)
Dexamethasone	3 (normal to < 5)
Diagnosis	

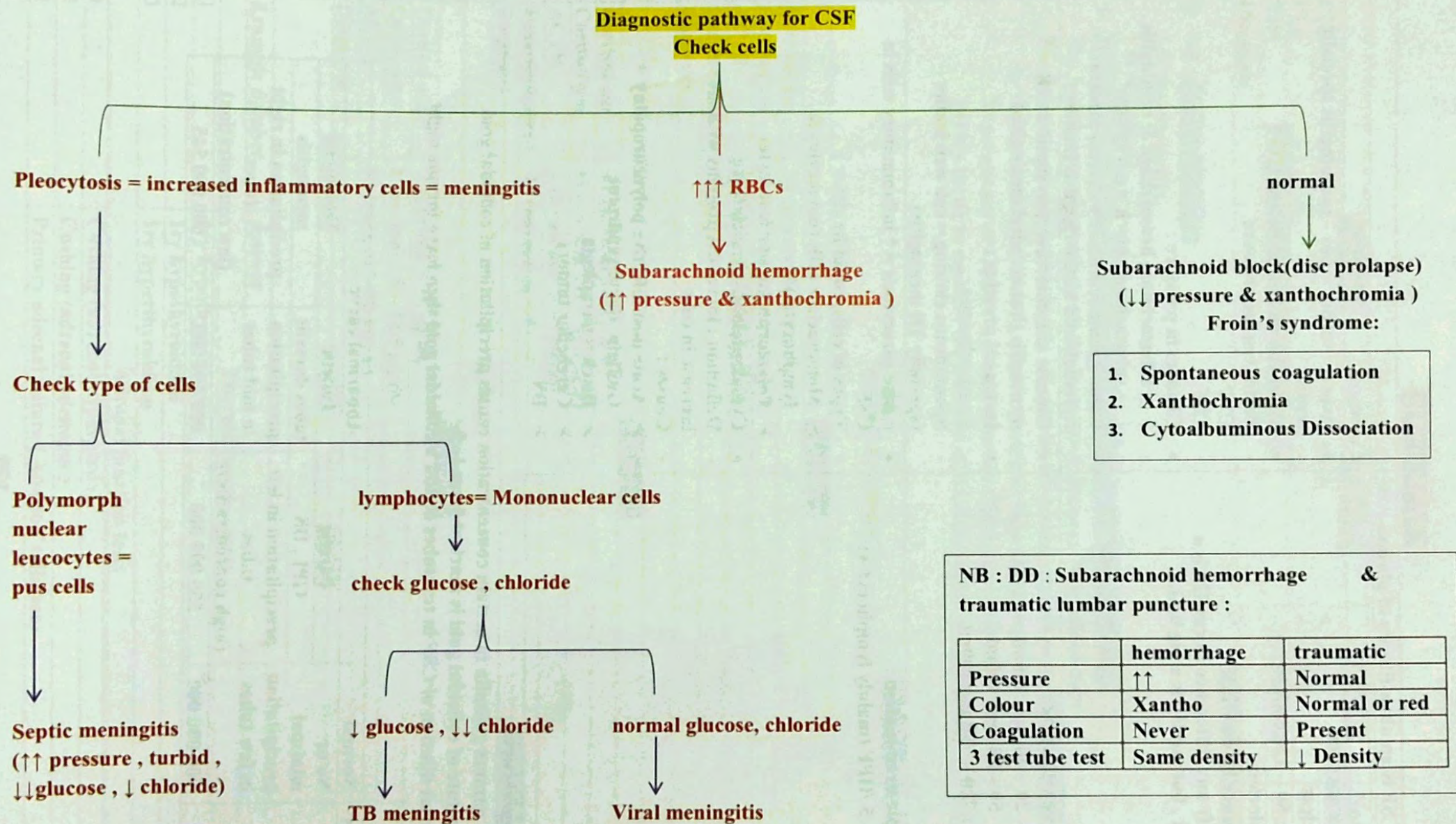
	Example 2
Cortisol am	41 (normal 5-25 µg/dl)
Cortisol pm	43 (normal 2.5 – 12.5 µg/dl)
ACTH	< 10 (normal 0-50 pg/ml)
Dexamethasone	15 (normal to < 5)
Diagnosis	

	Example 3
Cortisol am	1 (normal 5-25 µg/dl)
Cortisol pm	1 (normal 2.5 – 12.5 µg/dl)
ACTH	90 (normal 0-50 pg/ml)
Diagnosis	

Example number	Answer
Thyroid function tests	
1	1ry hypothyroidism
2	1ry hypothyroidism
3	1ry hyperthyroidism
Adrenal function tests	
1	Cushing (adrenal hyperplasia)
2	Cushing (adrenal adenoma)
3	Primary adrenal failure (Addison's disease)

CSF ANALYSIS

Definition : CSF is an ultra-filtrate of plasma																					
Normally	Comment																				
1. Physical properties • Aspect : clear • Pressure : 80 – 120 cmH2O • Color : colorless ❖ Why pressure by cmH2O? - To magnify any difference as cmH2O is a small unit , but mmHg is a big unit.	• Aspect : turbid = pus → meningitis specially septic. • What else measured by cmH2O ? - Portal venous pressure - CVP - CSF • Changes in pressure : - ↑ → subarachnoid hemorrhage & meningitis - ↓ → subarachnoid block = paraplegia • Color : xanthochromia → excess proteins, subarachnoid hemorrhage & jaundice																				
2. Chemical constituents : • Proteins : 20 – 40 mg / 100ml • Sugar : 50 – 80 mg / 100ml • Chlorides: 720 – 750 mg/100ml	• Glucose and chloride : ↓ in septic & TB meningitis (but not viral meningitis) • Increased proteins : - Xanthochromia - Spontaneous clotting = cob web bodies (specially TB meningitis)																				
3. Microscopic examination : • Cells : 0 – 5 /HPF (mainly lymphocytes)	• Cells : pleocytosis = ↑ inflammatory cells in CSF - Types of cells, could be either : ➢ Mononuclear cells (monocytes & lymphocytes) or ➢ Polymorph nuclear leucocytes • Cytoalbuminous dissociation : - Definition : increased proteins without increase in cells - Causes : ➢ Acute post infective polyneuropathy = Guillain-Barré syndrome ➢ Block = paraplegia ➢ Cerebellar tumors ➢ DS																				
4. Colloidal gold curve																					
• Increased gamma globulin in certain concentration causes precipitation of colloidal gold. • The precipitate of colloidal gold is marked from 1- 5 • We put serial dilution of CSF in test tubes & add a colloidal gold then leave for one night. • Results are :																					
<table><tr><th>Results</th><th>Normal</th><th colspan="3">Abnormal curve</th></tr><tr><td rowspan="4"></td><td rowspan="4">No or minimal precipitation in few tubes</td><td>Paretic</td><td>Tabetic</td><td>Meningitic</td></tr><tr><td>GPI , DS</td><td>tabes dorsalis</td><td>meningitis</td></tr><tr><td>precipitation in left tubes (high concentration)</td><td>precipitation in mid tubes</td><td>precipitation in right tubes (low concentration)</td></tr><tr><td>000 000 000</td><td>555 000 000</td><td>000 454 000</td><td>000 000 545</td></tr></table>	Results	Normal	Abnormal curve				No or minimal precipitation in few tubes	Paretic	Tabetic	Meningitic	GPI , DS	tabes dorsalis	meningitis	precipitation in left tubes (high concentration)	precipitation in mid tubes	precipitation in right tubes (low concentration)	000 000 000	555 000 000	000 454 000	000 000 545	
Results	Normal	Abnormal curve																			
	No or minimal precipitation in few tubes	Paretic	Tabetic	Meningitic																	
		GPI , DS	tabes dorsalis	meningitis																	
		precipitation in left tubes (high concentration)	precipitation in mid tubes	precipitation in right tubes (low concentration)																	
		000 000 000	555 000 000	000 454 000	000 000 545																



Report example for CSF :

Example 1	
Aspect	Turbid
Colour	Colourless
Proteins	150 mg/dl (15 – 45 mg/dl)
Sugar	5 mg/dl (45 – 80 mg/dl)
Choride	115 mmol/l (115 – 130 mmol/l)
Cells	300 cell/ μ l (polumorphnuclear)
Diagnosis	

Example 2	
Aspect	clear
Colour	xanthochromic
Proteins	200 mg/dl (15 – 45 mg/dl)
Sugar	65 mg/dl (45 – 80 mg/dl)
Choride	120 mmol/l (115 – 130 mmol/l)
Cells	5 cell/ μ l (mononuclear)
Diagnosis	

Example 3	
Aspect	clear
Colour	colourless
Proteins	40 mg/dl (15 – 45 mg/dl)
Sugar	60 mg/dl (45 – 80 mg/dl)
Choride	125 mmol/l (115 – 130 mmol/l)
Cells	90 cell/ μ l (lymphocytes)
Diagnosis	

Example	Answer
1	Bacterial meningitis
2	Xanthochromia
3	Viral meningitis



The CD contains MCQs questions for the clinical pathology : NEUROLOGY MCQS		
CSF analysis	From question no. 287	To question no. 293

REPORT OF ACUTE MYOCARDIAL INFARCTION

	➤ Non-specific Enzymes	➤ Specific; Isoenzymes
1.	• CPK = CK: Creatinine PhosphoKinase : Found in cardiac muscle , skeletal muscle , brain • Causes of increased total CPK activity : - Myocardial infarction - Muscular dystrophy - Muscle trauma e.g. IM injection - Severe exercise - Hypothyroidism	• CPK has 2 subunits : M , B - In heart only : CPK MB - In muscle only : CPK MM - In brain : CPK BB ✓ SO, ... If you suspect myocardial infarction look for CPK MB (Normal CPK MB = < 6 % of total CK)
2.	• LDH = LD : lactate dehydrogenase : found in cardiac muscle , skeletal muscle , liver , kidney , & erythrocytes • Causes of increased LDH activity : - Myocardial infarction - Megaloblastic anemia - Malignancy - Hepatocellular disorders - Hemolysis - Pulmonary infarction	• Has five isoenzymes : LDH 1 , LDH 2, LDH 3, LDH 4, LDH 5 - In heart only LDH 1 - In liver only : LDH 5 ✓ SO, ... If you suspect myocardial infarction look for LDH1
3.	• SGOT = AST : found in cardiac muscle , skeletal muscles , liver , kidney , & erythrocytes ✓ So look for SGPT = ALT which is specific to liver : - If high : origin of SGOT is liver - If normal : origin of SGOT is heart • Causes of increased AST activity : - Myocardial infarction - Muscular dystrophy - Hemolysis - Acute and chronic liver damage - Acute pancreatitis - Renal infarction	• No isoenzymes
4.	• Myoglobin : - Is a low molecular weight haem protein found in cardiac and skeletal muscles • Causes of increased myoglobin : - Trauma either to skeletal or cardiac muscles as in crush injuries and acute myocardial infarction	
5.	• Troponins : - The contractile proteins of all myofibrils include the regulatory proteins troponin .	• Troponin is a complex of three protein subunits : 1. Troponin C ; the calcium binding component 2. Troponin I ; the inhibitory component = TnI 3. Troponin T ; the tropomyosin binding component = TnT ❖ Cardiac specific troponins = cTn (cTnI & cTnT) ✓ SO, ... If you suspect myocardial infarction look for TnI & TnT

❖ **Cardiac markers pattern in AMI :**

	Initial rise	Peak	Back to normal
Total CPK	4 – 8 hr	12 – 24 hr	3 -5 days
CK-MB	3 – 8 hr	12 – 24 hr	2 – 3 days
LDH	10 – 12 hr	48 – 72 hr	5 – 14 days
AST	6 – 12 hr	18 – 36 hr	4 – 6 days
Myoglobin	1-3 hr	6 – 9 hr	1 day
cTnI	3- 8 hr	24 – 48 hr	3 – 5 days
cTnT	3- 8 hr	24 – 48 hr (1 st peak) 72 – 100 hr (2 nd peak)	5 – 10 days

Examples for Cardiac profiles :

Example 1	
CK	140 U/L (Normal : 0 – 170)
CK MB	20 U/L (normal 0 – 24)
SGOT	30 U/L (normal 0 – 32)
LDH	790 U/L (normal 240 – 480)
Diagnosis	

Example 2	
CK	300 U/L (Normal : 0 – 170)
CK MB	40 U/L (normal 0 - 24)
SGOT	23 U/L (normal 0 – 32)
LDH	360 U/L (normal 240 – 480)
Diagnosis	

❖ **Diagnosis of MI :**

- Typical chest pain of infarction
- ECG of MI; pathological Q wave
- Enzymes elevation

❖ **Importance of enzymes :**

- Confirm diagnosis of MI in special types
 - Painless MI
 - Non-Q wave infarction “ subendocardial infarction”
- Timing of infarction
- Detect efficacy of thrombolytic therapy

Example number	Answer
1	Elevated LDH for DD e.g. myocardial infarction after 1 week or pulmonary infarction or hemolysis
2	Recent myocardial infarction



The CD contains MCQs questions for the clinical pathology : CARDIOLOGY MCQS		
Myocardial infarction	From question no. 294	To question no. 300

SEROLOGY TESTS

1. Widal test :

- Definition:** agglutination test for diagnosis of salmonella infection (typhoid & paratyphoid)

• Antigens	• Antibodies
- Somatic antigen (O Ag) : non-specific, same for all types	- O antibodies : recent acute infections : non-specific, same for all types
- Flagellar antigen (H Ag) : specific for each type (typhoid , paratyphoid A , paratyphoid B)	- H antibodies : old infections & vaccination , persists for life & specific for each type

- Normal antibodies titre :**

	Normal
Anti – O	1/40 – 1/80
Anti - H typhoid	1/40 – 1/80
Anti – H paratyphoid A	1/80 – 1/100
Anti – H paratyphoid B	1/80 – 1/100

- Drawbacks of Widal test :**

- Only Positive from second week
- Needs Rising titre which is more important for diagnosis than single high titre
- Affected by antibiotic therapy

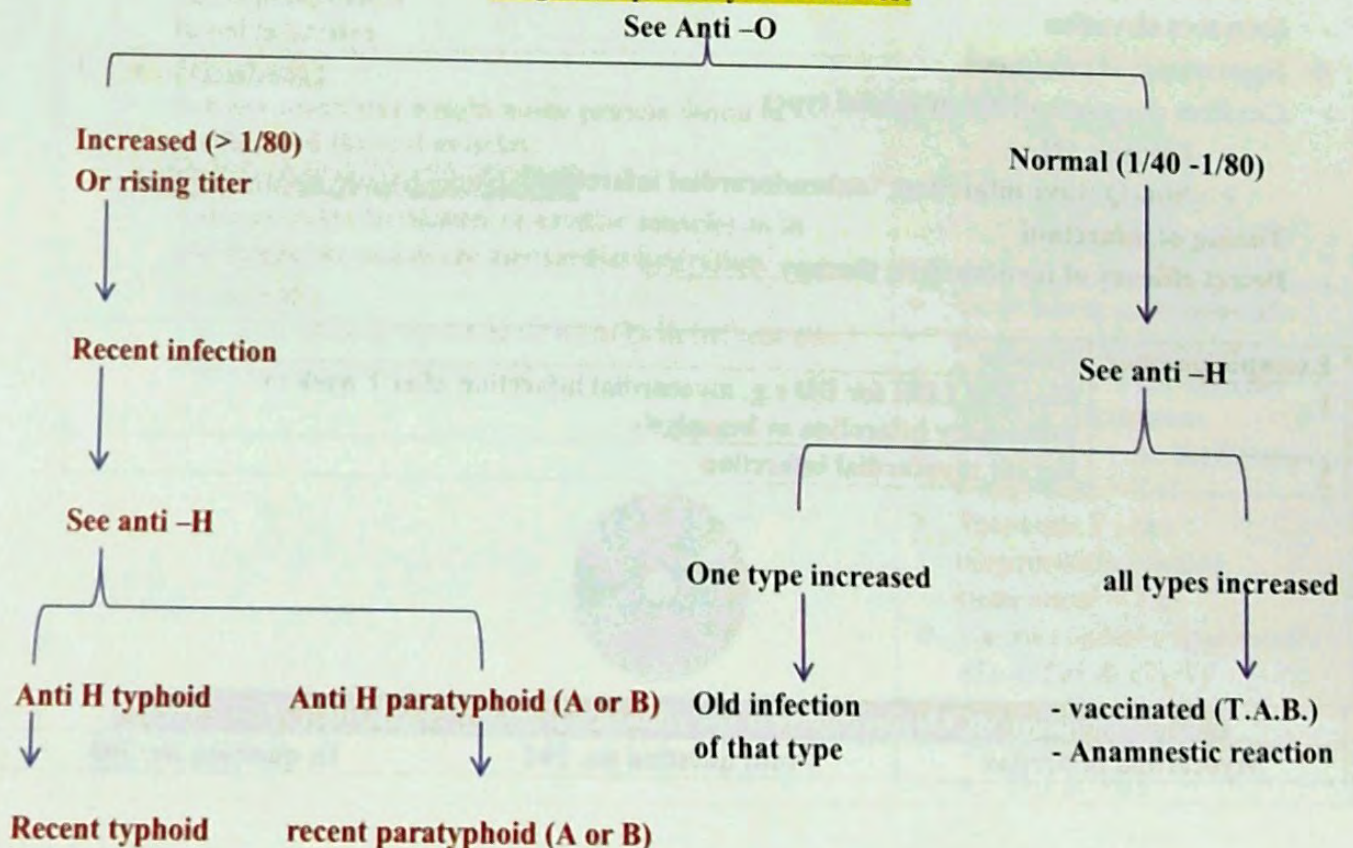
- Salmonella is better diagnosed by detection of antigens by culture from**

- Blood in 1st week
- Stool in 2nd week
- Urine in 3rd week

- NBs :**

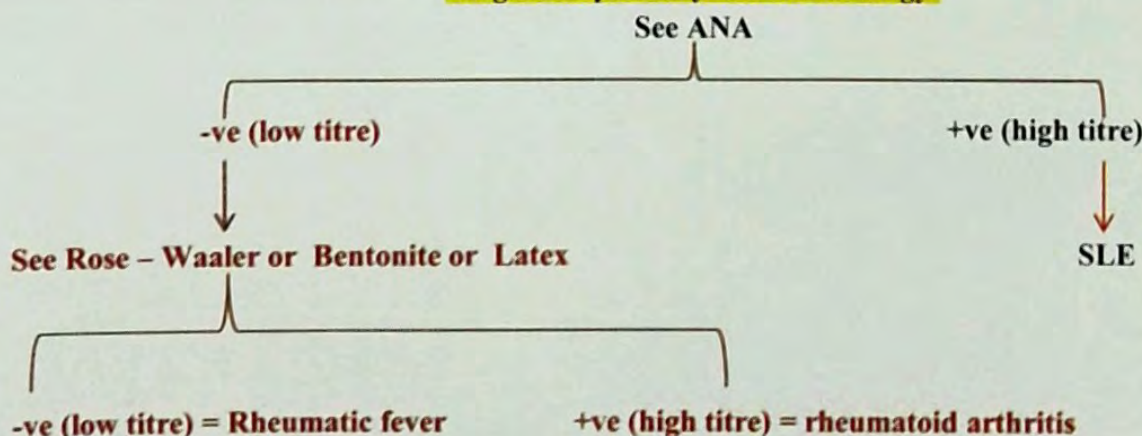
- Vi (virulence) antibody is the last to rise & its persistence indicates a carrier state
- Anamnestic reaction : improper antibody response to non-related antigen caused by febrile illness causing sharpe rise of H antibody and low O titre

Diagnostic pathway of Widal test



2. Brucella agglutination : • Positive in brucellosis from second week • A titre > 1/160 is diagnostic especially if rising
3. Paul – Bunel & monospot test : • Positive in infectious mononucleosis • Serum contain heterophil Ab agglutinating sheep RBCs
4. Weil – Felic test : • Positive in typhus
5. Rose – Waaler , Bentonite & Latex test : • 3 serological test to detect Rheumatoid factor • Rheumatoid factor is a collection of autoantibodies including IgM formed against altered IgG , RF is not specific may be present in many conditions e.g. rheumatoid arthritis
6. Antistreptolysin O titre : ASOT • Normally < 250 Todd's unit • Positive in recent streptococcal infection (better rising titre) e.g. In rheumatic fever , glomerulonephritis , pharyngitis , tonsillitis , scarlet fever
7. C-reactive protein : CRP : • Normal absent , it's graded from +1 → +4 • Positive in tissue damage (acute phase reactant; in acute and chronic conditions)
8. Coomb's test : for immune hemolytic reaction - Direct : detect fixed RBCs Ab - Indirect : detect free RBCs Ab in serum (severe cases)
9. Antinuclear antibodies : ANA for SLE
10. ESR : See blood
❖ Skin tests : A. Tuberculin for TB B. Casoni test for hydatid disease C. Kveim test for sarcoidosis D. Schik test for detection of non-immune Diphtheria E. Dick test for scarlet fever
❖ Media : A. Lowenstein Jensen medium for TB B. Loffler's medium for diphtheria
❖ Stains : A. Gram stains B. Ziehl-Neelsen stain for TB C. Modified Ziehl-Neelsen stain for TB D. Giemsa stains for malaria

Diagnostic pathway of rheumatology:



Report example for Serology:

	Normal	Example 1	Example 2	Example 3
Anti O	1/40 - 1/80	1/120	1/40	1/40
Anti H typhoid	1/40 - 1/80	1/160	1/40	1/160
Anti H Para A	1/80 - 1/100	1/100	1/250	1/250
Anti H Para B	1/80 - 1/100	1/100	1/100	1/250
Diagnosis				

	Normal	Example 4	Example 5	Example 6
ESR	4 - 7 (westergren)	110	80	90
CRP	-ve	+4	+3	-ve
ASOT	< 200 Todd's units	700	100	80
Rose Waaler	-ve < 1/32	< 1/32	1/64	1/32
ANA	-ve	-ve	-ve	+ve
Diagnosis				

Example number	Answer
1	Recent typhoid infection
2	Old paratyphoid type A
3	Vaccinated (TAB)
4	Recent streptococcal infection e.g. rheumatic fever
5	Rheumatoid arthritis
6	Systemic lupus erythematosus



The CD contains MCQs questions for the clinical pathology : SEROLOGY & IMMUNOLOGY MCQS		
Serology & immunology	From question no. 301	To question no. 339

STOOL ANALYSIS

❖ Normal :

1. Volume :

- ≤ 200 gm /day unless excess dietary fibers are ingested
- Diarrhea : Loose stool or frequent motion > 4 times / day or both
- Constipation : infrequent bowel evacuation(> 48 hr.) and passage of hard small stools

2. Consistency : soft , well formed

3. Colour : light to dark brown

4. Odour : fecal (not offensive)

5. Reaction : alkaline

6. Contents :

- Mucus , pus , RBCs : absent
- Fat : < 6 gm / day

Diagnostic pathway

See fat content

Normal ≤ 6 gm / day

increased > 6 gm/day or $> 25\%$ of total weight

Look for RBCs if +ve = Dysentery

See pus cells and mucus

Malabsorption syndrome
(Steatorrhea)

Mainly split fat

mainly unsplit $> 25\%$

Malabsorption
(intestinal)

Mal-digestion
(Pancreatic
hepatobiliary)

	Amebic dysentery	Bacillary dysentery
Pus cells	++	++++
Mucus	++++	++
	Amebic cyst or vegetative forms	Gram -ve bacilli

Report examples for stool analysis :

	normal	Example 1	Example 2	Example 3	Example 4
Volume	200 gm/day	180	300	350	350
Consistency	Soft, well formed	Loose	Loose (watery)	Loose	
Colour	Brown	Brown			
Odour	Fecal	Offensive	Offensive	Offensive	Offensive
Reaction	Alkaline	Acidic	Alkaline	Alkaline	Alkaline
• Contents :					
- Mucus	---	Excess , ++++	Slight +	Slight +	Slight +
- Pus cells	---	++	++++	---	---
- RBCs	---	+++	+++	---	---
- Food residues	---	+	+	++	++ (meat fibers)
- Others	---	Ameba cyst	Gm - bacilli		
Fat content	< 6 gm/day			10 gm/day	11 gm/day
- Split fat	---	---	---	90 %	50 %
- Unsplit fat	---	---	---	10 %	50 %
Diagnosis					

Example number	Answer :
1	Amebic dysentery
2	Bacillary dysentery
3	Mal-absorption (intestinal)
4	Mal-digestion (pancreatic hepatobiliary)



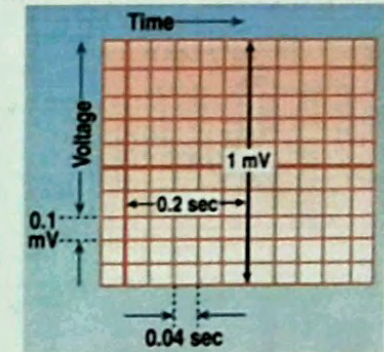
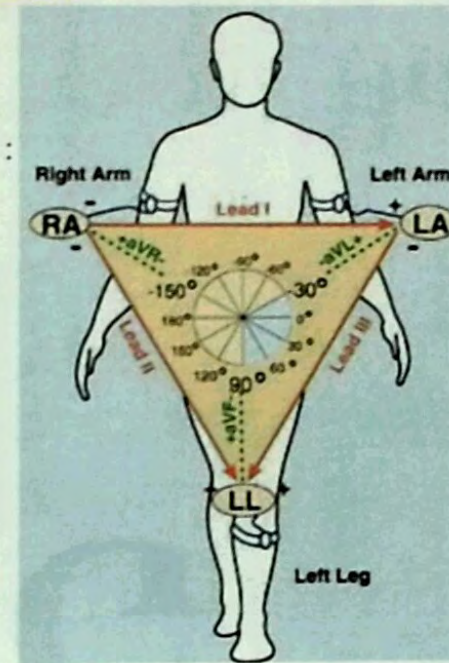
The CD contains MCQs questions for the clinical pathology : STOOL ANALYSIS MCQS		
Stool analysis	From question no. 340	To question no. 343

ECG

الذي يرحون بالدموع يحدون بالابتهاج
انظروا إلى الأجيال القديمة وتأملوا. هل توكّل أحد على الرب فخزي؟
الذي بدأ معك أول الطريق له يدرك في منتصفه
هو شاف هو عارف مش ينسى ☺

Electrocardiogram:

- **Definition :** ECG is the recording of the heart electric activity
- **Leads :** 12 leads
 - A. 6 limb leads, it gives a potential difference between 2 points :
 - 3 bipolar (standard) : LI , LII , LIII
 - 3 unipolar (augmented) : avR, avL, avF
 - B. 6 precordial (chest) leads, it gives an isolated point at each :
V1 , V2 , V3 , V4 , V5 , V6
 - C. Leads are described in Einthoven triangle
 - D. Value of leads in relation to heart :
 - LI , V1→V6 : record anterior surface
 - LII, III , avF : record inferior surface
 - LI, avL, , V5, V6 : record lateral surface

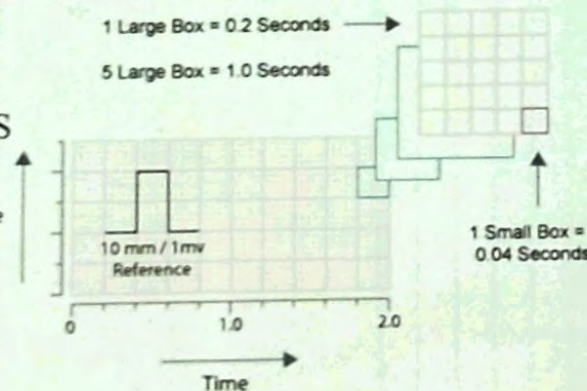


• Normal ECG :

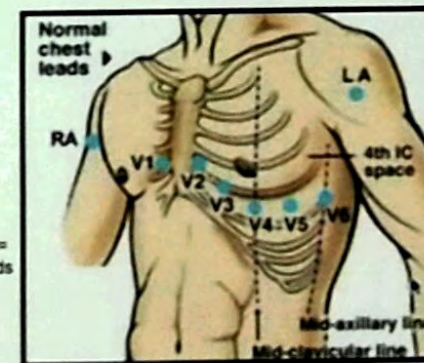
- P wave : atrial depolarization
- QRS complex : ventricular depolarization
- T wave : ventricular repolarization
- NB: repolarization of the atria masked by QRS.

• Tape :

- 0.04 sec. = 1 **Small Square (SS)**
- 0.2 sec = 1 **Large Square (LS)** = 5 SS
- 1 second = 5 LS = 25 SS
- 1 minute = 300 LS = 1500 SS
- 1mv = 2LS = Standard calibration
- 0.1 mv = SS
- LS = 5 SS

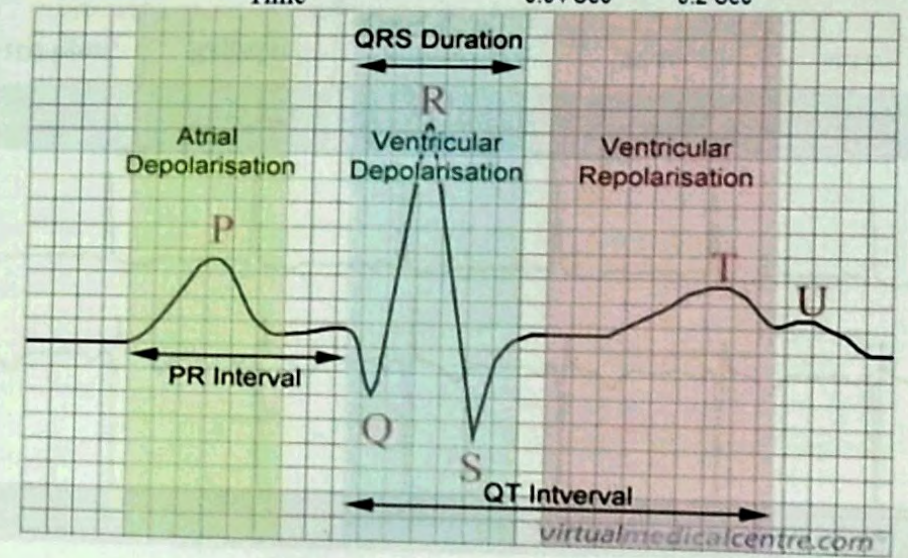
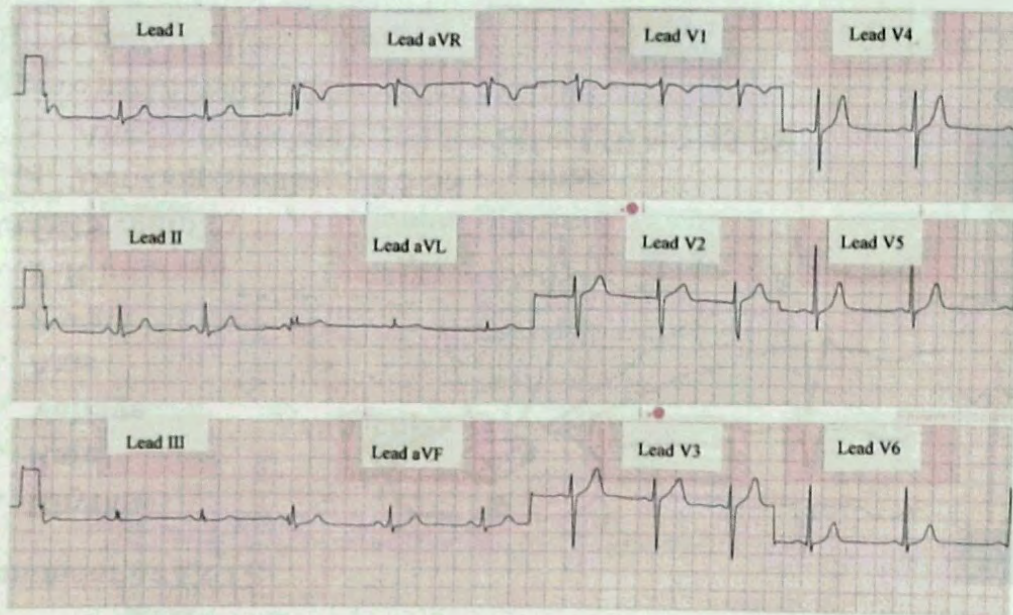
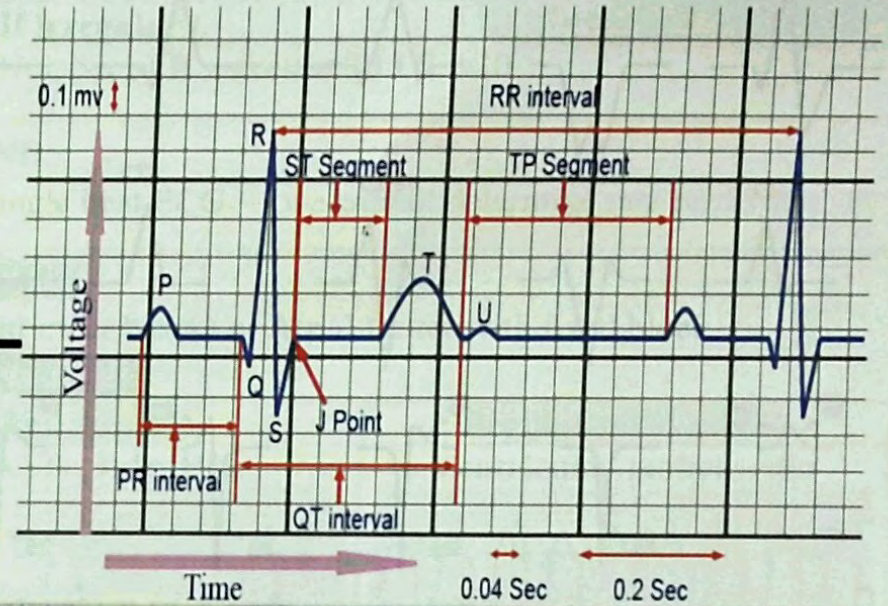
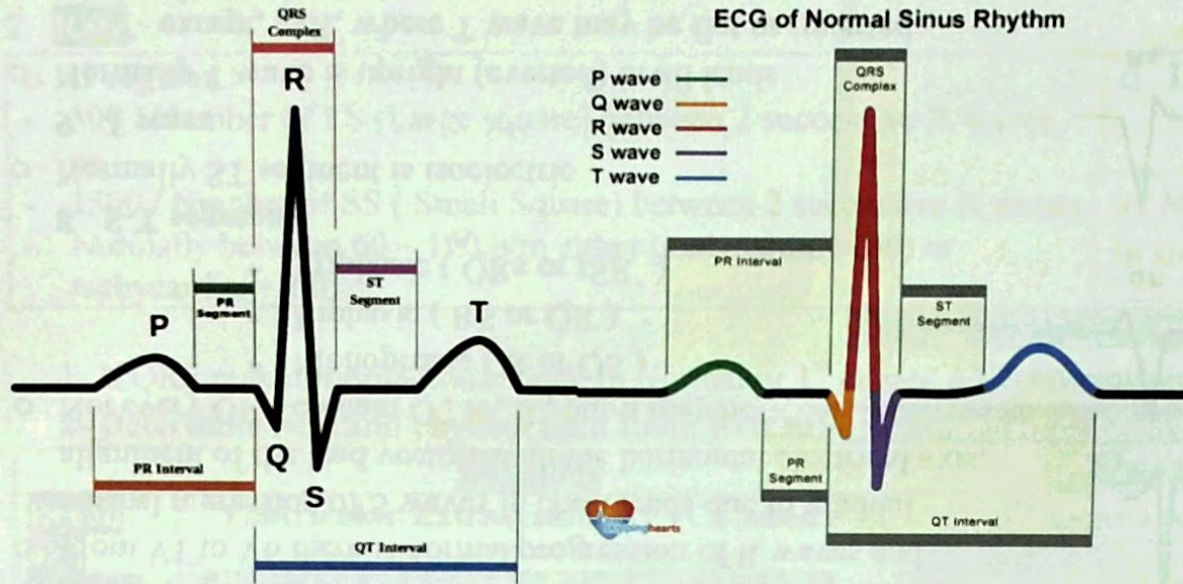


Precordial or Chest Leads



- | | |
|----------------|---|
| V ₁ | 4th intercostal (right) |
| V ₂ | 4th intercostal (left) |
| V ₃ | Between V ₂ & V ₄ |
| V ₄ | Midclavicular
(mid-collarbne) |
| V ₅ | 5th intercostal space
(anterior axillary line) |
| V ₆ | 5th intercostal
(midaxillary line) |

Normal ECG:



Comment on ECG:

1. Rhythm

2. Rate

3. Voltage

4. Axis

5. P wave

6. P-R interval

7. QRS complex

- Duration (width): < 2.5 SS ,
- Amplitude (height) : in LI + LII + LIII = ≥ 15 SS

- **Q:** -ve part of QRS not preceded by any +ve
- **R:** +ve part of QRS
- **S:** -ve part of QRS preceded by any +ve
- From V1 to V6 there is normal progression of R waves and normal regression of S waves in chest leads due to gradual alignment of the lead vectors with the horizontal electrical axis.
- Not every QRS contain Q , R , S , but it may be
 - Monophasic (R or QS)
 - Biphasic (RS or QR)
 - Triphasic (QRs or rSR')

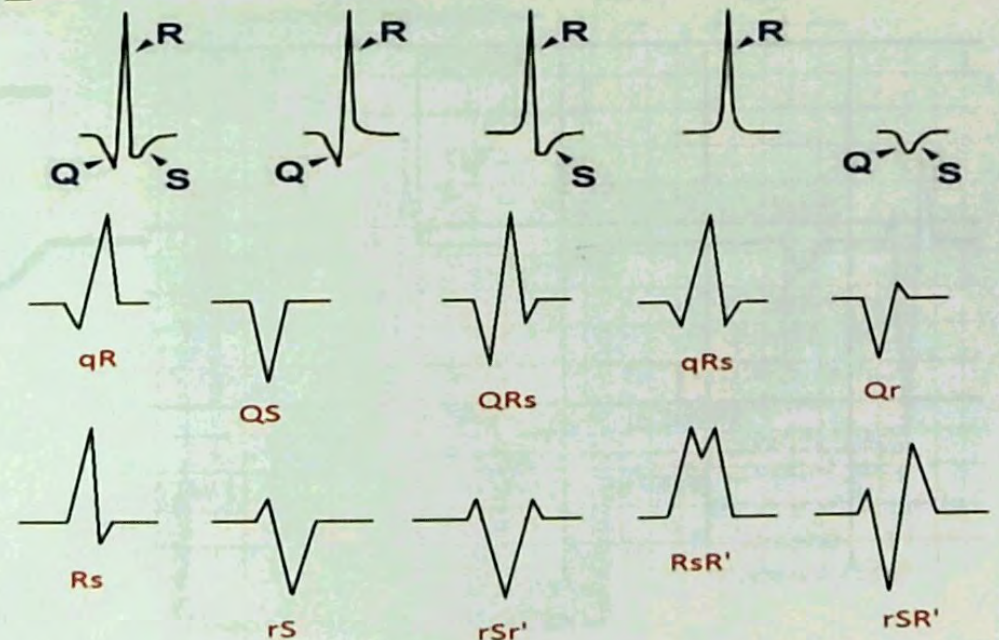
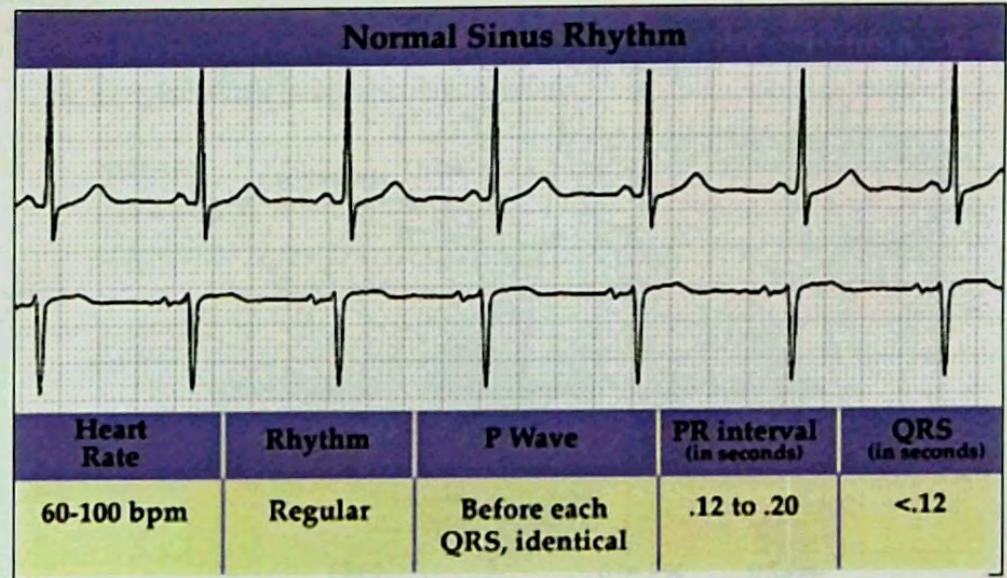
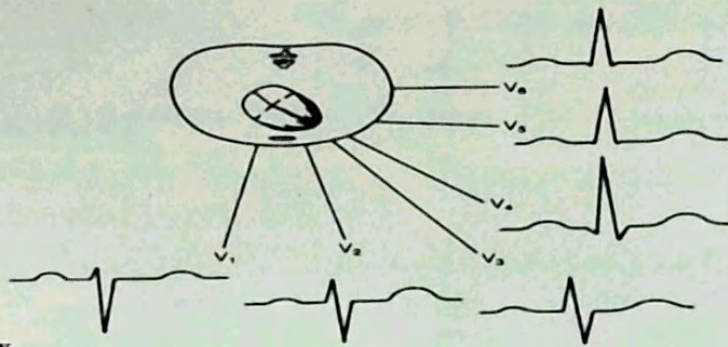
8. S-T segment

- Normally ST segment is isoelectric

9. T wave

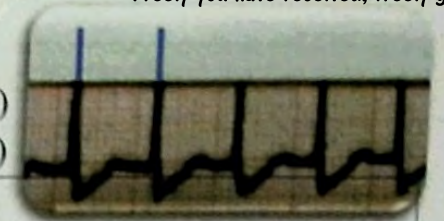
- Normally T wave is upright (everted) in all leads except, avR, where T wave may be flat or inverted

10. Diagnosis



Comment on ECG

1. **Rhythm** : regular or irregular by paper test by measuring the space between two successive QRS (R to R) or (S to S)
2. **Rate**,

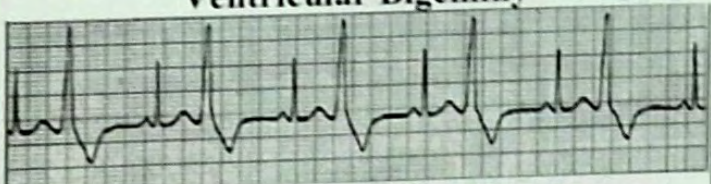
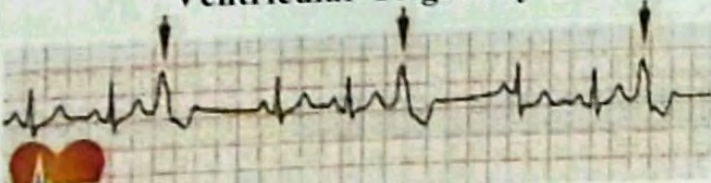
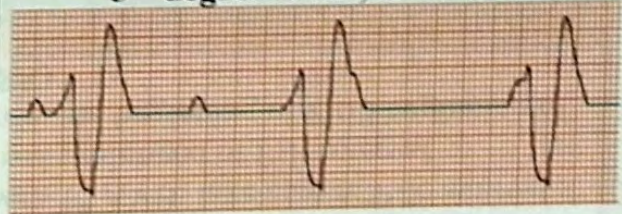
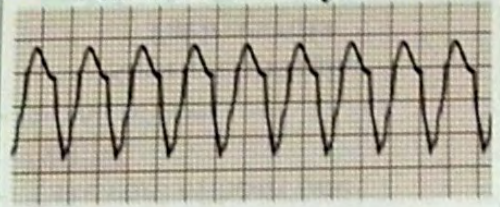


- | | |
|--|--|
| <ul style="list-style-type: none"> ○ If regular : <ul style="list-style-type: none"> - $300 / \text{Number of LS (Large square) between 2 successive R waves}$ or - $1500 / \text{Number of SS (Small Square) between 2 successive R waves}$ - Normally between 60 – 100 b/m either bradycardia (<60) or tachycardia(>100). | <ul style="list-style-type: none"> ○ If irregular : <ul style="list-style-type: none"> - $\text{Number of R waves in 30 LS} \times 10$ ➤ NB:
In single beat ECG → we cannot determine rate or rhythm. |
|--|--|

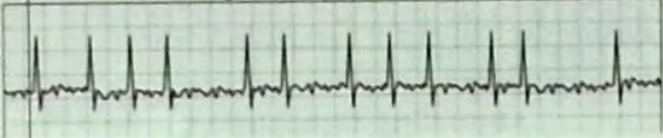
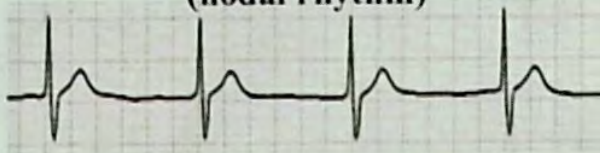
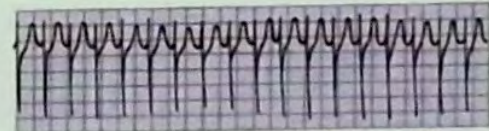
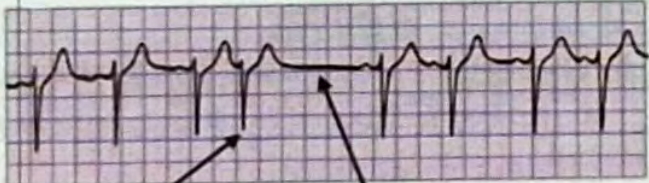
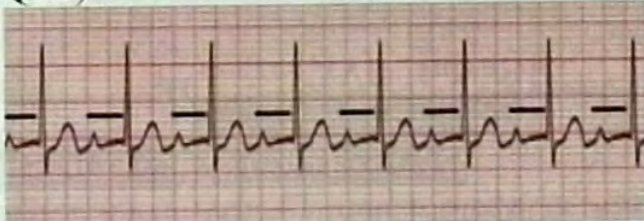
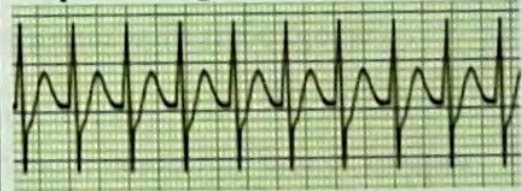
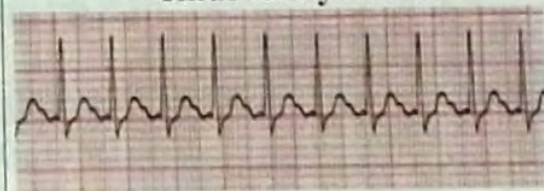
✓ Rhythm strip scheme :

1- If QRS regular normal rate: think in Normal or 1st degree AVB (Atrioventricular block) or Atrial flutter with fixed block.

2- Determine rate and rhythm then Look first to **QRS: if broad & bizarre (wide)**

	Irregular	Regular bradycardia	Regular tachycardia
Broad and Bizarre QRS (Wide) NB : PVCs = premature ventricular contractions	Ventricular Extrasystole = PVCs (normal P wave)  Extrasystole Pause Ventricular Bigeminy  Ventricular Trigeminy 	3rd degree AVB , InfraHiss 	Ventricular tachycardia 

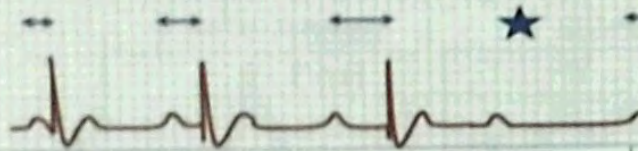
3-If QRS Narrow Normal → check P wave ; could be absent or single or multiple :

	Irregular	Regular bradycardia	Regular tachycardia
Absent P wave	AF = Atrial fibrillation على السطر P wave absent , replaced by f wave which may be : coarse , fine , absent 	Mid Junctional rhythm (nodal rhythm) 	Supraventricular tachycardia (nodal ; absent P wave) Junctional (nodal) tachycardia 
Single P wave	❖ There is a space , return back to see the relationship between last two beats (QRS) Either : ➢ Crowded : Supraventricular Extrasystole , there is compensatory pause  Early QRS Compensatory pause Or ➢ Normal : - Variable 2nd AVB , check P-R interval either : Mobitz type I OR Mobitz II	Sinus bradycardia , usually associated with 1st AVB; take care of P-R interval : Fixed prolonged of P-R interval (from the beginning of P till beginning of QRS)  NB: <u>supraventricular extrasystole could be either:</u> - Nodal = premature nodal contractions (PNCs) → inverted or absent P <u>or</u> - Atrial= premature atrial contractions (PACs) → abnormal (deformed) P wave : ➢ Atrial extrasystole ➢ Atrial Bigeminy ➢ Atrial Trigeminy	➢ Take care of heart rate : Either ➢ > 160 b/m = Supraventricular Tachycardia - Atrial : the P wave are superimposed on the preceding T wave.  ➢ Or 100 → 160 b/m = sinus tachycardia 

Mobitz type I:

- Progressive prolongation of PR interval till dropped of QRS (Wenckbach)

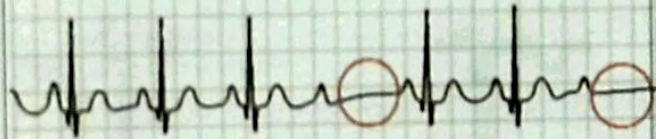
MOBITZ TYPE 1



Or

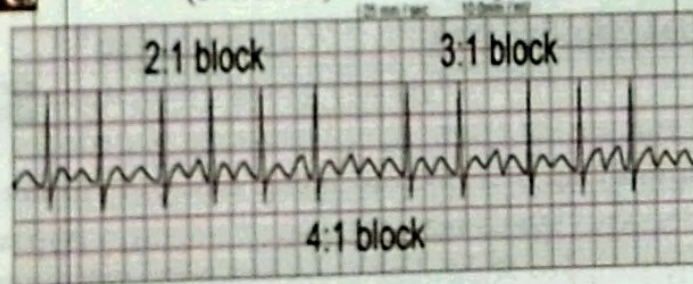
Mobitz II:

- Dropped QRS without lengthening of PR interval (Constant).



Multiple P waves

Atrial flutter with variable block
(F waves) saw teeth pattern

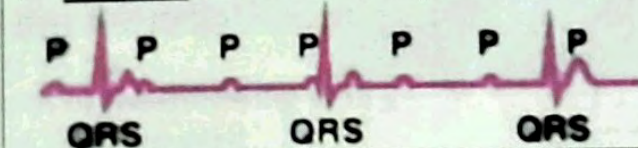


- ❖ Check the number and site of P between each 2 QRS :

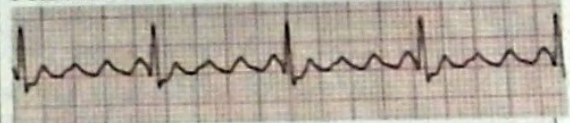
Either

- **Fixed** : 2nd AVB , fixed block : 3 : 1 **or**

- **Variable** : 3rd AVB (SupraHiss)



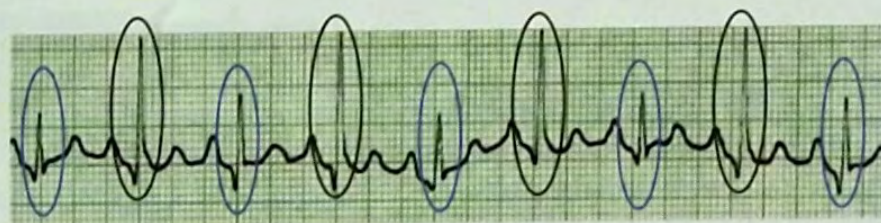
Atrial flutter with fixed block ,
4: 1 = saw teeth pattern
Atrial rate = No of P x HR



✓ **Complete ECG scheme** : = rhythm strip scheme (from the completed lead) + the following :

3. Voltage:

- Normal voltage : QRS amplitude in LI + LII + LIII = ≥ 15 SS
- ❖ **Causes of low voltage** : QRS amplitude in LI + LII + LIII = < 15 SS
 - Pericardial effusion : **electrical alternans** may occur due to beat to beat alteration of QRS axis due to swinging of the floating heart in the effusion
 - Cardiomyopathy, ischemia, infarction, myxedema, emphysema



4. Axis : from lead I & avF (or III)

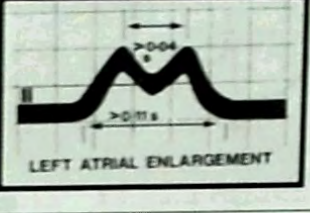
	Normal axis	Left axis deviation أهل الشمال : متخاصمين	Right axis deviation أهل اليمين : يسلموا على بعض	Extreme axis deviation = No man's land لا بتاعك ولا بتاعه
Lead I	+ve QRS 	+ve QRS 	-ve QRS 	-ve QRS
Lead III or avF	+ve QRS 	-ve QRS 	+ve QRS 	-ve QRS
Causes		○ LVH ○ LBBB ○ Left anterior hemiblock ○ Ascites ○ Hyperkalemia ○ Inferior infarction ○ Normal	○ RVH ○ RBBB ○ Left posterior hemiblock ○ Chronic lung disease ○ Pulmonary embolism ○ Lateral infarction ○ Normal	Causes of RAD + LAD except normal.

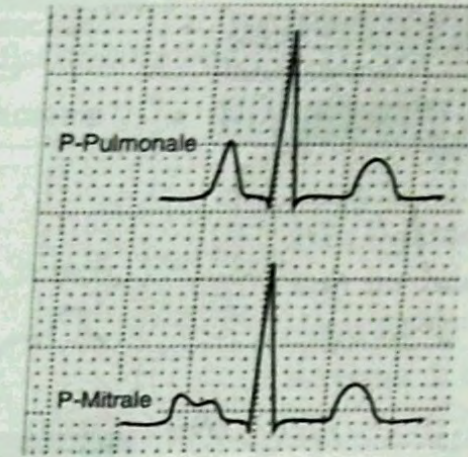
5. Lead II :

1- شكل
Atrial
+++

❖ P wave :

- Normal = 2.5 x 2.5 SS
- Represent atrial depolarization ; sinus rhythm
- Abnormally :

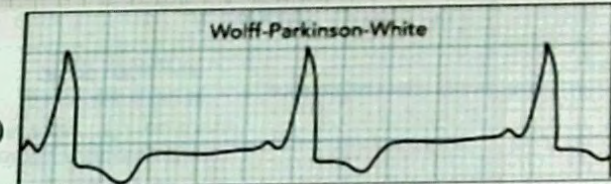
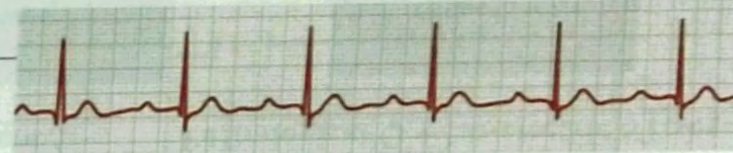
Tall & Peaked P pulmonale	Broad & Bifid P mitrale	P- Pulmonale- mitrale
		
RA +	LA +	Biatrial +
Causes : TR, TS, RVF	Causes : MS, MR, LVF	



2- كطول
1st AVB

❖ P-R interval :

- From the beginning of P till beginning of QRS
- Normal : 3 – 5 SS
- Abnormally :
- Fixed prolonged (>5SS) of PR interval : 1st AVB
- Short (<3SS) PR interval & wide QRS & Delta wave (initial slowing of QRS) = Wolff Parkinson White Syndrome



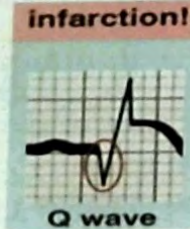
3- يا إما
كجلطة

❖ Normal Q wave :

- less than 1 SS in width , less than 2 SS in height (amplitude) or < 25 % of depth of the following R in ↓
- Normally in lead I & avL , **V5 , V6**

❖ Abnormally : Pathological Q = infarction : تعرفنا ان فيه جلطة

- In any site rather than normal
- > 1 SS in ↔ , > 2 SS in ↓ , > 25 % of depth of the following R in ↓
- Present in at least two successive leads in the same wall

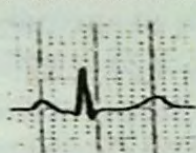


• DD of pathological Q:

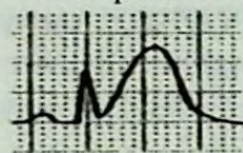
- Myocardial infarction
- Myocarditis
- Hypertrophic cardiomyopathy
- Infiltrative muscle disease
- LBBB

الزمان عن طريق J point

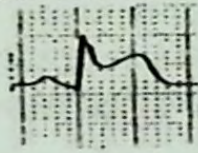
- **ST segment and T wave ; normal ST segment is isoelectric (with absence of pathological Q) & T wave is upright :**
Look for J point :
- **J point :** The point at which the QRS complex finishes and the ST segment begins, it is used to measure the degree of ST elevation or depression present in relation to the baseline of ECG which is PR segment.



Normal



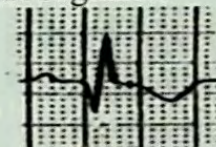
**Hyperacute
T-Wave
minutes-hours**



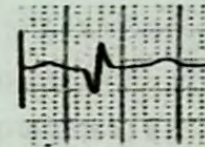
**ST-elevation
0-12 hours**



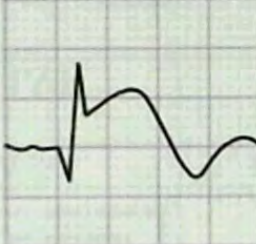
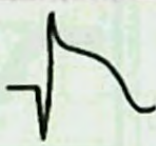
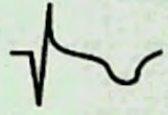
**Q-wave
developing
over
1-12 hours**



**ST-elevation
With T-wave
Inversion
2-5 days**



**T-wave
recovery
weeks-months**

Recent Hyperacute MI NO Pathological Q + ST segment ↑	Recent acute MI Pathological Q + ST segment ↑	Chronic (Old) MI Pathological Q + iso-electric ST seg.
 	    	 
• NO pathological Q or poor R progression • ST segment elevation • ± Hyperacute T wave (tall(>2LS), narrow, symmetrical & peaked)	• Pathological Q or poor R progression • ST segment : elevation (Convex upwards) then descending to baseline • T wave : biphasic then symmetrically inverted	• Pathological Q or poor R progression • ST segment & T wave : normal or elevated if old MI with aneurysm

المكان عن طريق البحث عن نفس التغيرات عند إخوانه :

• **Topography of myocardial infarction :**

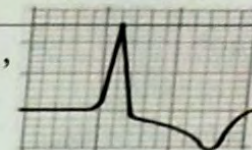
- Lead : II, III, avF = inferior myocardial infarction

يا إما
كإسكيما

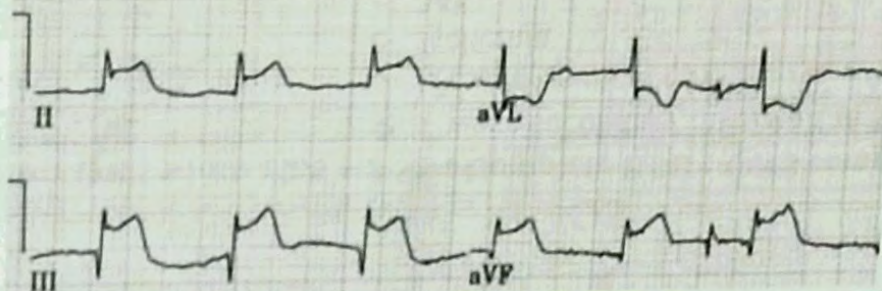
- **Ischemia** = ST segment depression with depressed J point and T wave flat or inverted ,

• **Topography of ischemia :**

- Lead : II, III, avF = inferior myocardial ischemia



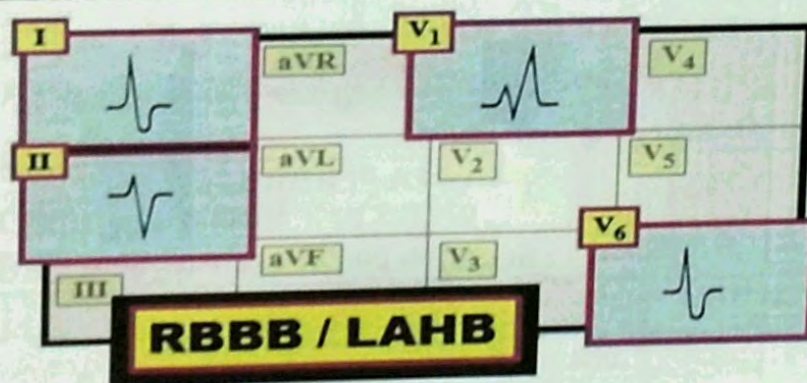
Recent acute inferior
myocardial infarction



NB: Double infarction
may be present in the
same ECG, one of them
is recent & the other is
old.

○ **Hemiblock = Fascicular block**

4- كبلوك

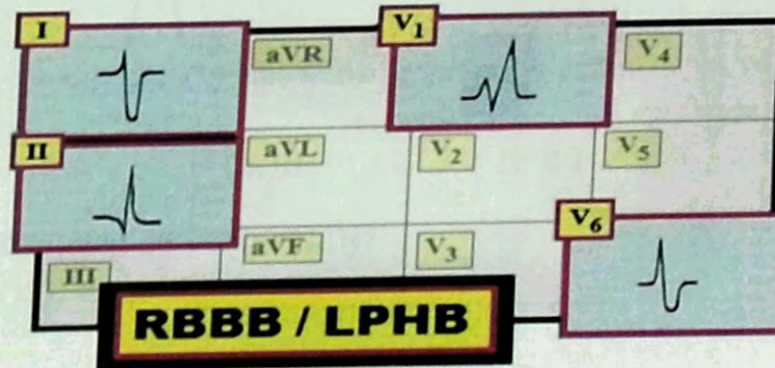


Left anterior hemiblock

- LAD + Deep S wave (R/S ratio < 1) in II , III , avF

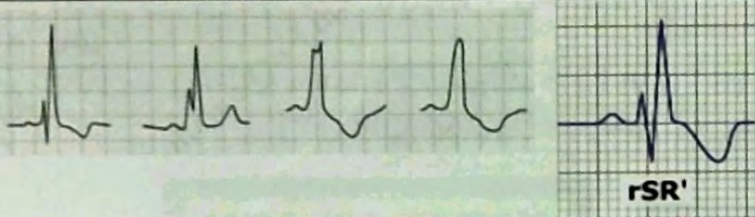
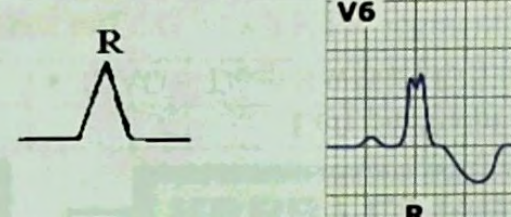
➤ **NB :**

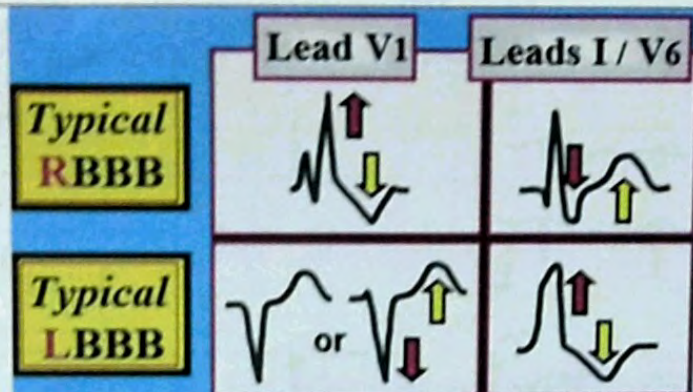
- Bifascicular block = RBBB + Hemiblock
- Trifascicular block = RBBB + Hemiblock + 1st degree AVB



Left posterior hemiblock

- RAD + Deep S wave (R/S ratio < 1) in I & avL

6-	V1	V6
1- يا إما كشكل BBB	RBBB (Right Bundle Branch Block) 	LBBB (Left Bundle Branch Block) 
	QRS • RR'; monophasic notched tall R OR • rSR' (with wide R'); M shaped = RBBB in V1 , V2 ○ للتأكد هتلاقى عند : V5 & V6 , lead I → qRs (with large slurred s) 	❖ BBB = Wide QRS > 2.5 SS ○ Monophasic (± notched) (R) = LBBB in V5 , V6, lead I ○ للتأكد هتلاقى عند : V1 & V2 → QS (the entire complex is negative) or rS  ○ Incomplete BBB : QRS width : 2.5 – 3 SS , Complete BBB : QRS complex width > 3 SS
T wave Causes	❖ T wave secondary inversion in V1,V2 ○ RV enlargement (ASD , PS , PH , P.embolism) ○ Ischemia ○ Inferior MI ○ Degeneration by age ○ RT sided catheter ○ Rate dependent ○ Normal	❖ T wave secondary inversion in V5,V6 ○ LV enlargement (HTN , AS , AR) ○ Ischemia ○ MI ○ Calcification of mitral annulus ○ Cardiomyopathy ○ Rate dependent ○ Normal



NB:

إذا لم تحقق شكل ال BBB :

لا تكمل رحلة البحث عن الطول وعن الجلطة أو إسكيميا

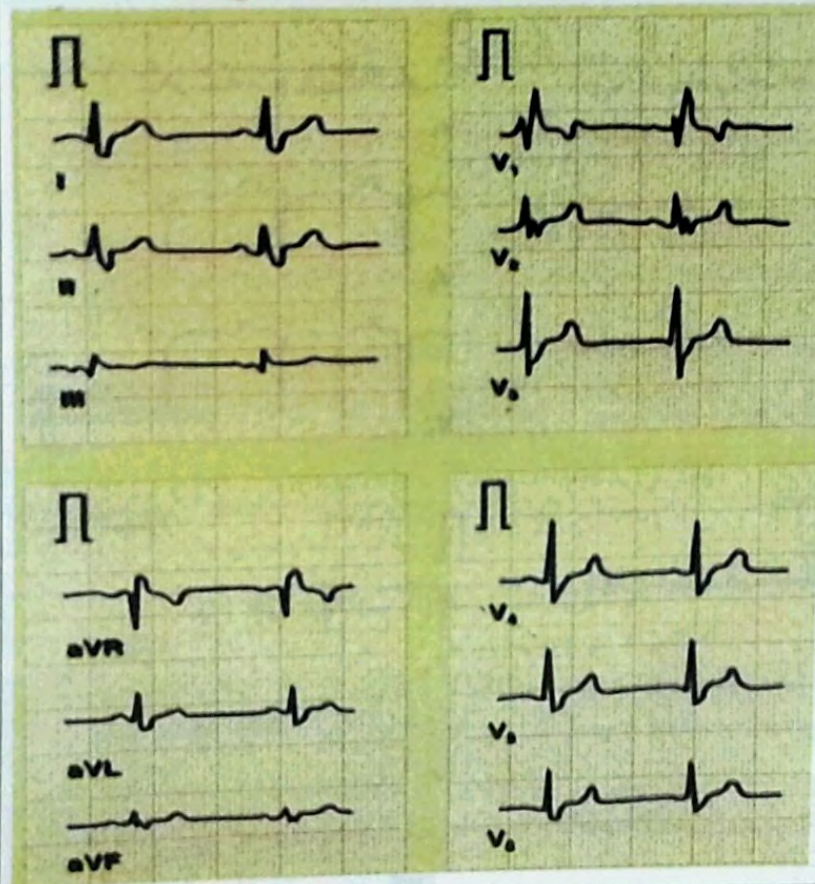
○ In RBBB , don't diagnose :

- Myocardial ischemia
- Ventricular enlargement

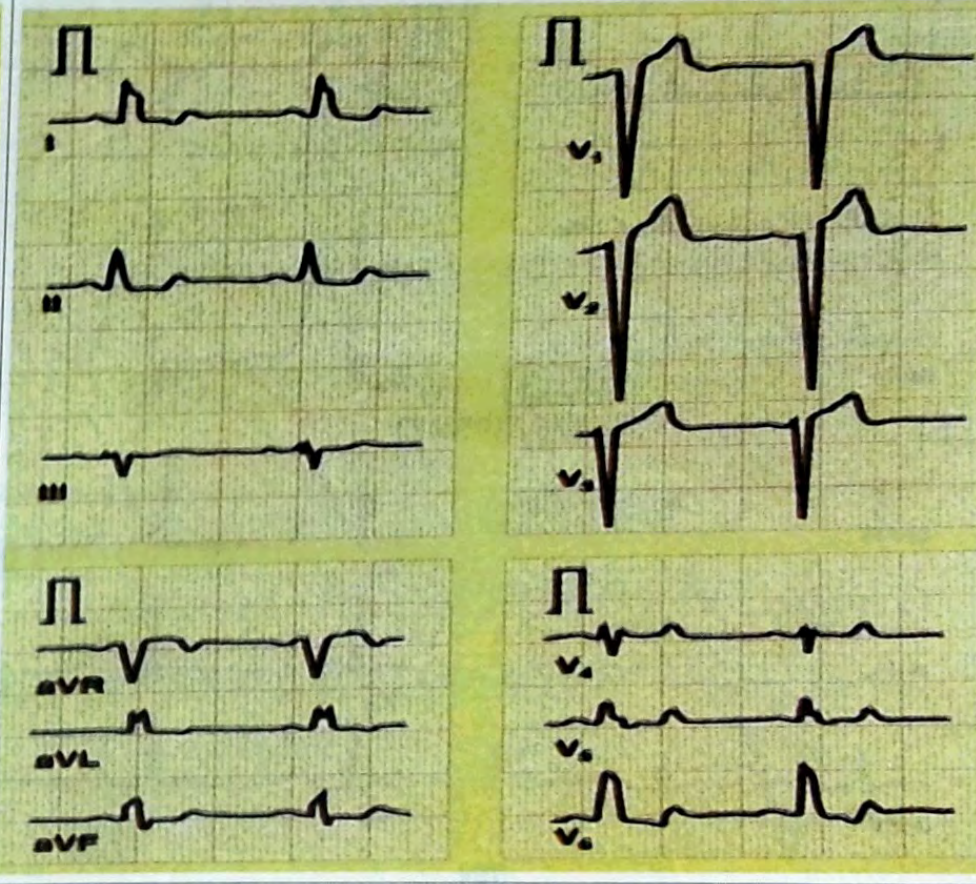
○ In LBBB , don't diagnose :

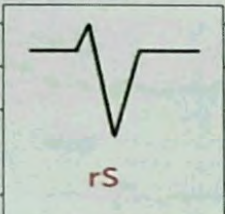
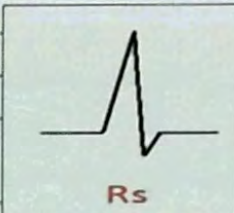
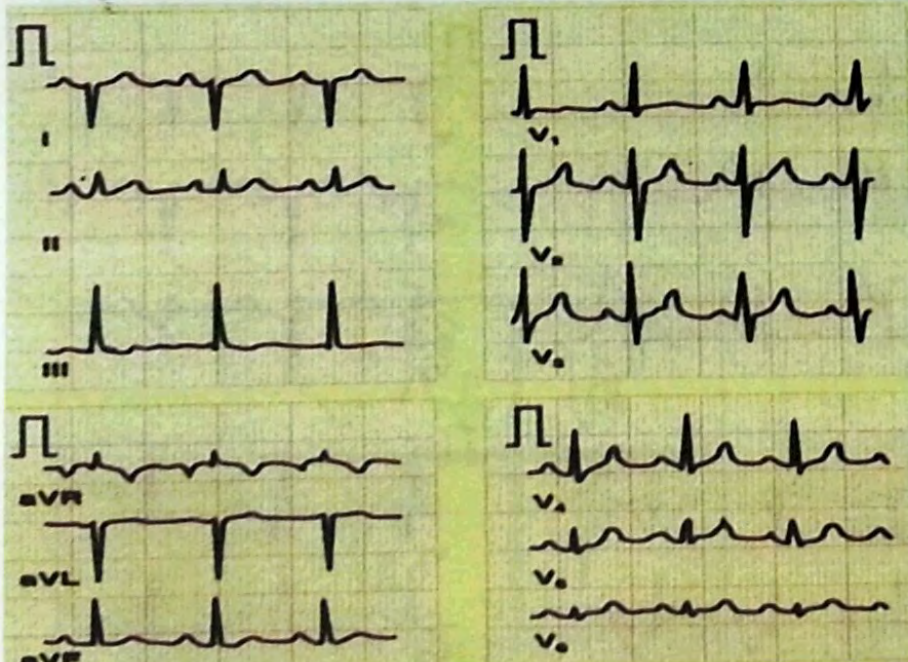
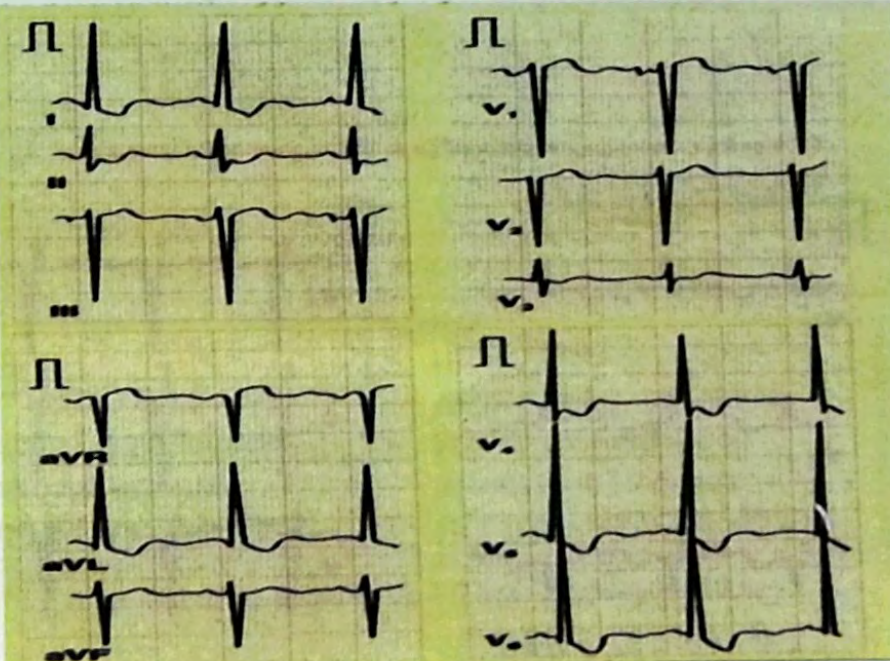
- Myocardial ischemia
- Myocardial infarction
- Ventricular enlargement
- Hemiblock

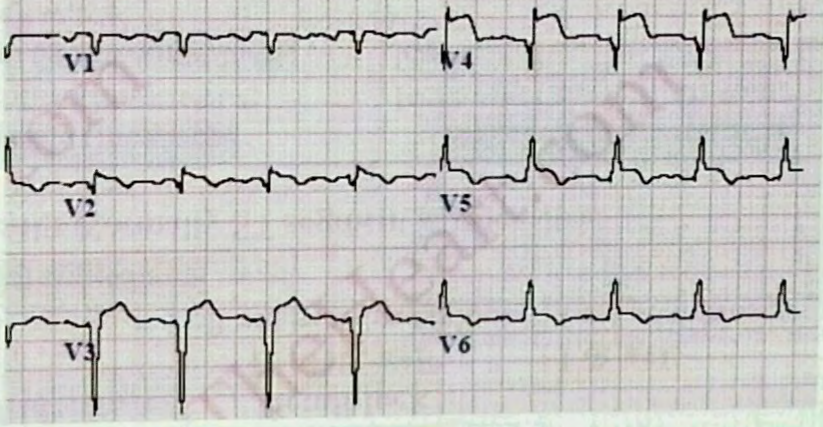
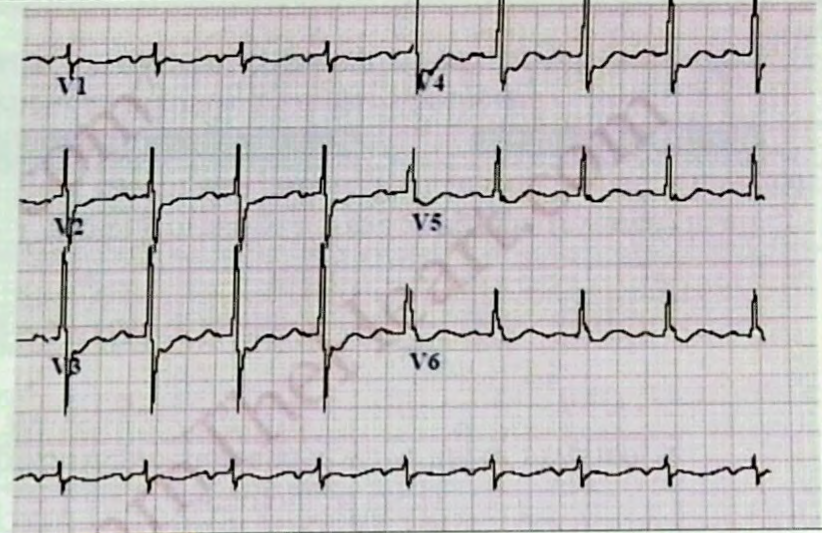
Right bundle branch block



Left bundle branch block



يا إما كطول VH	V1		V6	
				
	❖ QRS			
	❖ Normal			
	rS		Rs	
	❖ Abnormally :EITHER : Exaggerated > 5 LS بالبلدي (LS = 5 mm)			
	بالعلمي	S in V1, V2 > 25 mm		R in V5, V6 > 25 mm
	Left Ventricular Hypertrophy		Left Ventricular Hypertrophy	
	OR بالبلدي Inverted			
	بالعلمي	Dominant R= R/S ratio in V1 ≥ 1		Deep S = R/S ratio in V6 < 1
Right <u>V</u> entricular <u>H</u> ypertrophy (VH)		Right <u>V</u> entricular <u>H</u> ypertrophy (VH)		
❖ Strain pattern :		❖ Strain pattern :		
ST segment depression ± T wave inversion in V1 , V2		ST segment depression ± T wave inversion in V5 , V6		
NB : biventricular hypertrophy (enlargement) :				
- Signs of LVE + tall R in V1 Or Signs of LVE + RAD				
Right ventricular hypertrophy		Left ventricular hypertrophy		
				

	V1	V6 هنا لازم تطبق الشروط
2- يا إما كجلطة	Infarction; Same principles as in Lead II but the topography is different :	
	- V1 – V2 = septal - V3 – V4 = anterior - V1 → V3 (±V4) = antero-septal	- Lateral: V5-V6, I , avL = - High lateral : I , avL - Low lateral : V5 , V6 - V3→V6, I ,avL = antero-lateral - V1→V6, I , avL = extensive anterior
يا إما كإسكيميا	Ischemia = ST segment depression with depressed J point and T wave flat or inverted Topography of ischemia : as above	
	Recent anterolateral MI	Antero-lateral ischemia
		

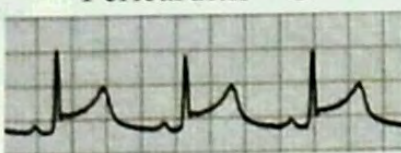
ECG Leads & walls of the myocardium

ECG Leads & Walls of the Myocardium							
I	High lateral	avR		V1	Septal	V4	Strict anterior
II	Inferior	avL	High lateral	V2	Septal	V5	Low lateral
III	Inferior	avF	Inferior	V3	Strict anterior	V6	Low lateral

Revision of ECG scheme:

	1- Rhythm	2- Rate	3- Voltage	4- Axis
	5- Lead II			
1- كشكـل	P wave			
2- كطـول	P-R interval			
3- يا إما كجلطـة	Pathological Q			
يا إما كإسكـيما	ST segment depression and T wave flat or inverted			
4- كبـلوك	Hemiblock			
	II , III , avF		I & avL	
	Left anterior hemiblock		Left posterior hemiblock	
			6- V1	7- V6
			BBB	
			لو تحقـق شكـل ال BBB لا تكـمل رحلـة البـحث عـن الطـول و عـن الجـلطـة أو الإسكـيما	
			Ventricular hypertrophy	
			Pathological Q	
			ST segment depression and T wave flat or inverted	

Differential diagnosis of:

○ ST segment : Normally ST segment is isoelectric		○ T wave : Normally T wave is upright (everted) in all leads except avR, where T wave may be flat or inverted	
Raised ST segment	Depressed ST segment	Flat or inverted T wave	Hyperacute T wave
Myocardial infarction Convex upwards , in some leads , pathological Q wave Elevated cardiac enzyme	Ischemia (angina), In some leads	Ischemia (angina) , In some leads	Ischemia
Pericarditis 😊 	Hypokalemia in all leads	Hypokalemia in all leads	hyperkalemia
Concave upwards , in all leads Absent pathological Q wave			
Prinzmetal angina flat , in all leads Absent pathological Q wave	Strain pattern of ventricular hypertrophy	Strain pattern of ventricular hypertrophy	Acute MI
Old MI + aneurysm	Sagging depression of digitalis	BBB	Normal variants

Miscellaneous :

❖ Other Advanced ECG:

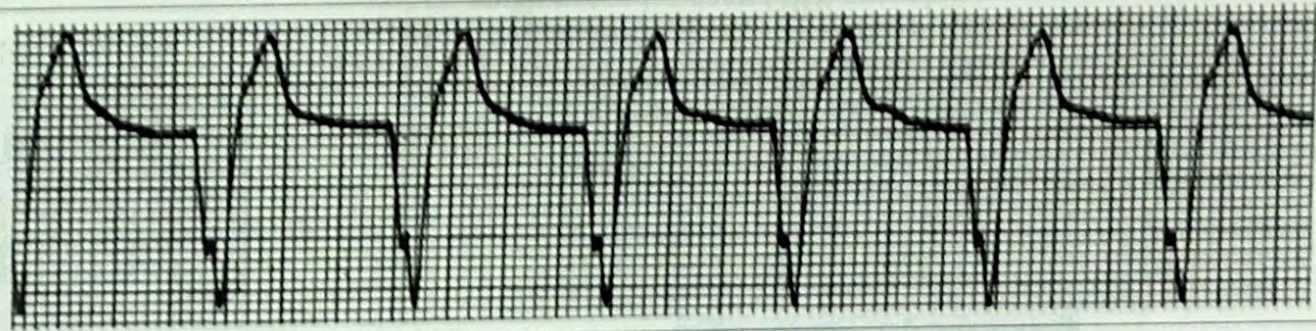
- **Wandering atrial pacemaker** in cases of Sick sinus syndrome
 - ≥ 3 different P waves
 - Irregular rhythm
 - Normal rate



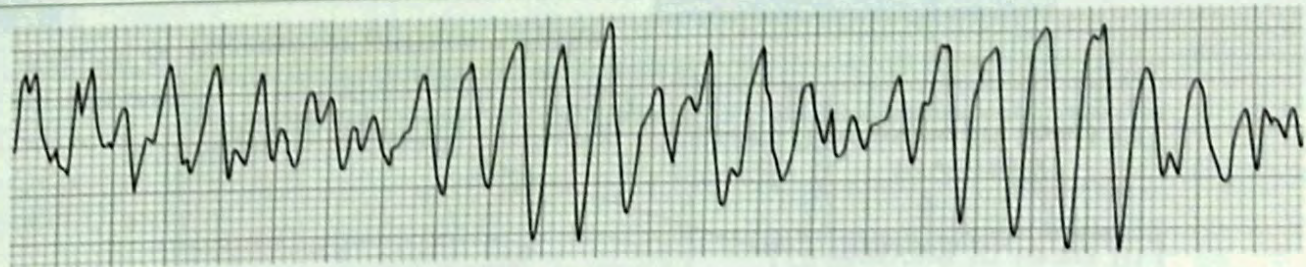
- **Multifocal atrial tachycardia** in cases of chronic hypoxia e.g. COPD
 - ≥ 3 different P waves
 - Irregular rhythm
 - Tachycardia

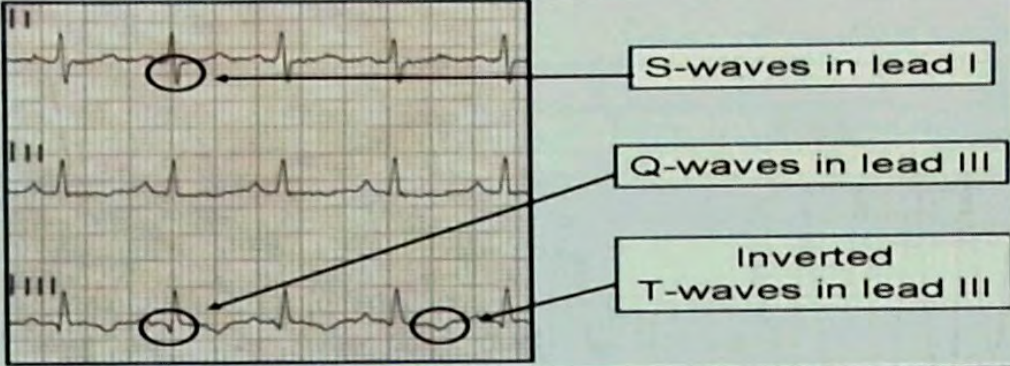
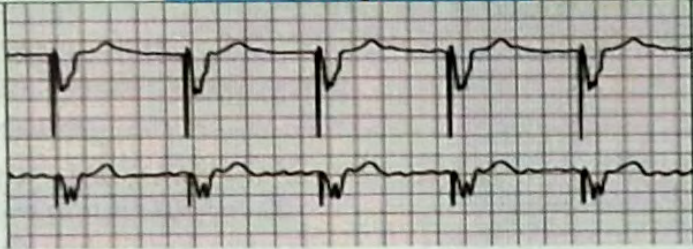


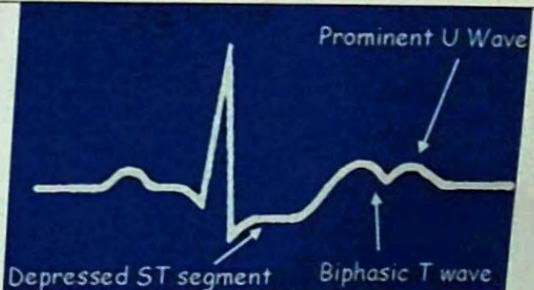
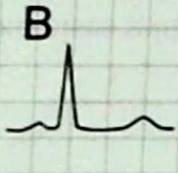
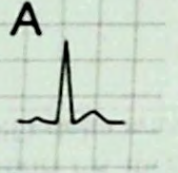
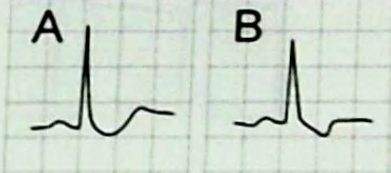
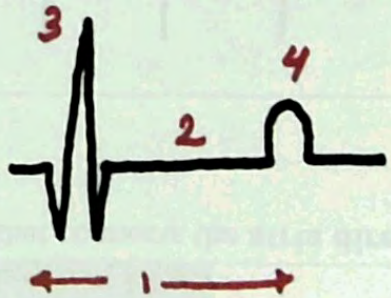
- **Accelerated idioventricular rhythm** is the commonest reperfusion arrhythmia .
 - Rate 40 – 100 b/m
 - Regular rhythm
 - P wave : absent or not related
 - PR interval : none
 - QRS : wide



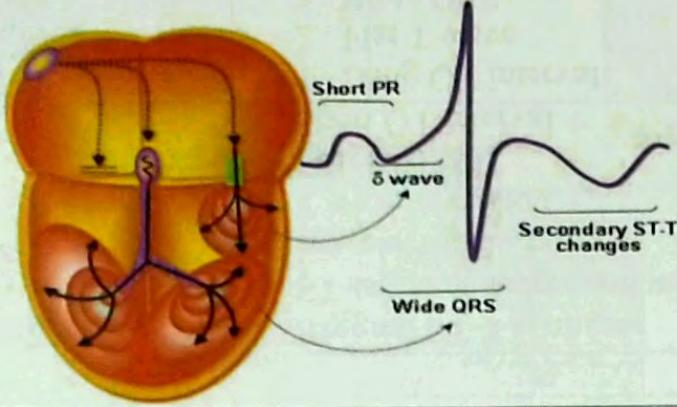
- **Torsades de pointes**
 - Polymorphic ventricular tachycardia
 - Wide QRS complexes.
 - Preceded by long and short RR-intervals
 - Long QT interval from the beginning of Q wave to the end of T wave



Pulmonary Embolism - Sinus Tachycardia - RAD - RBBB - S1, QIII, TIII : ▪ Deep S in Lead I, ▪ Pathological Q & Inverted T in Lead III	 S-waves in lead I Q-waves in lead III Inverted T-waves in lead III
❖ Pacemaker pattern = Spike	
Ventricular pacemaker 	Dual chamber pace maker 
A spike precedes each QRS complex	- Two spikes : ○ spike precedes each QRS complex ○ another spike is seen before P wave
NB: If pacemaker spike is not followed by a complex , this means failure of pacing = pacemaker malfunction	
❖ Electrolyte disturbance	
Disorder & Causes Hyperkalemia: - Renal failure - Addison syndrome - Acidosis	ECG In sequences : 1. Hyperacute T wave 2. Long PR interval 3. Lost P wave 4. Wide QRS complex (>2.5SS) 5. Sine wave pattern 6. Asystole 

Hypokalemia : - Diuretic therapy - Secretory diarrhea - Cushing syndrome	1. ST segment depression 2. Prominent U wave (fused to T wave) 3. Long QT interval (normal QT interval = $\frac{1}{2}$ RR)	 Depressed ST segment, Prominent U Wave, Biphasic T wave
Hypocalcemia : - Malabsorption - Pancreatitis - Hypoparathyroidism	Long QT interval	 B
Hypercalcemia : - Hyperparathyroidism - Paget's diseases of the bone - Multiple myeloma	Short QT interval	 A
❖ Drugs		
Digitalis effect	1. Sagging ST-T changes: - ST segment depression with iso- electrical J point - T wave inversion - Fused ST & T 2. Short QT interval	 A B
Quinidine , Procainamide & Disopyramide	1. Long QT interval 2. Flat T wave 3. Wide QRS 4. Prominent U wave	 3 2 4 1

❖ Pre-excitation syndromes = Short PR interval

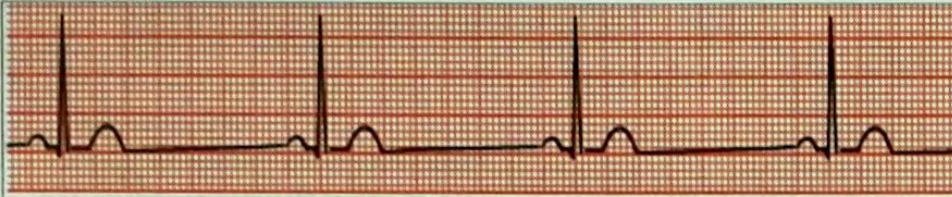
Wolff Parkinson White syndrome (WPW)	Lown Ganong Levine (LGL)
- Accessory pathway from atria to ventricles parallel to AV-junction but : - It has no delay of conduction - It conduct impulses from atria to ventricles & vice versa	Accessory pathway that connects the atria directly to the bundle of His.
	
Short PR interval & wide QRS & Delta wave (initial slowing of QRS) = Wolff Parkinson White Syndrome	Short PR interval NO delta wave , NO wide QRS

• Revise from your theoretical book the followings :

- Angina
- Myocardial infarction
- Arrhythmias (causes , treatment)
- Causes of atrial and ventricular enlargement.
- Attached with the book a CD which contains, more than 150 ECG exercises with the model answer.



ECG exercises



Answer: Sinus bradycardia



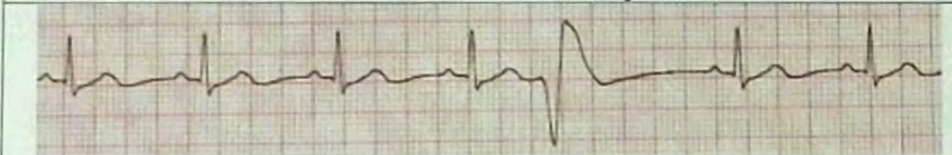
Answer: Sinus tachycardia



Answer: Ventricular tachycardia



Answer: Supraventricular (atrial) tachycardia



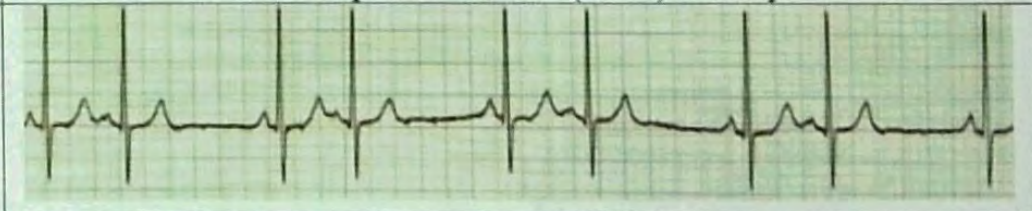
Answer: Ventricular extrasystole



Answer: Supraventricular (atrial) extrasystole



Answer: Ventricular Bigeminy



Answer: Atrial Bigeminy



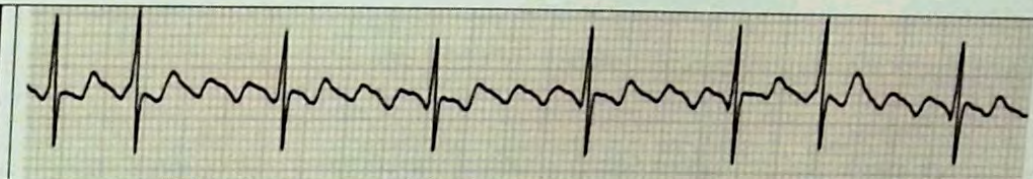
Answer: Ventricular Trigeminy



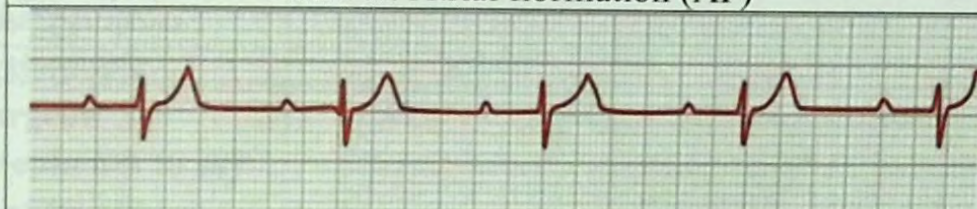
Answer: Atrial Trigeminy



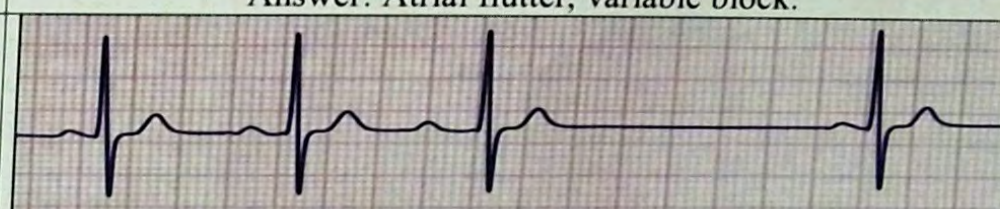
Answer: Atrial fibrillation (AF)



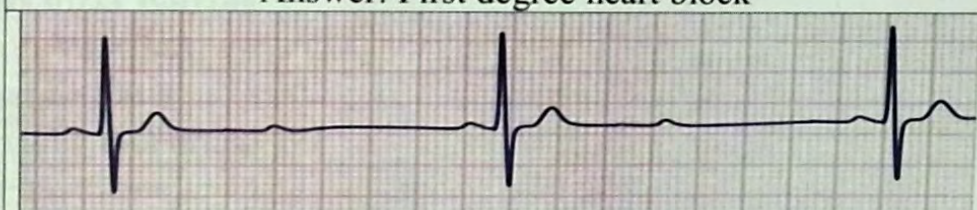
Answer: Atrial flutter, variable block.



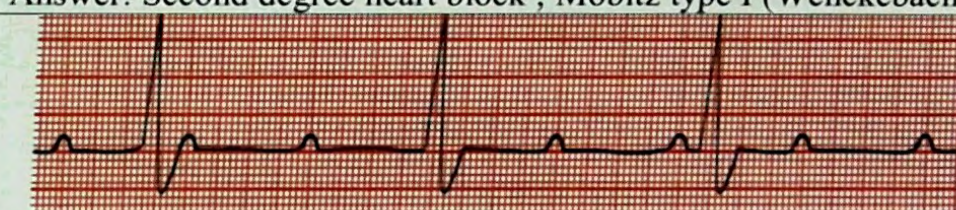
Answer: First degree heart block



Answer: Second degree heart block ; Mobitz type I (Wenckebach)



Answer: Second degree heart block ; Mobitz type II



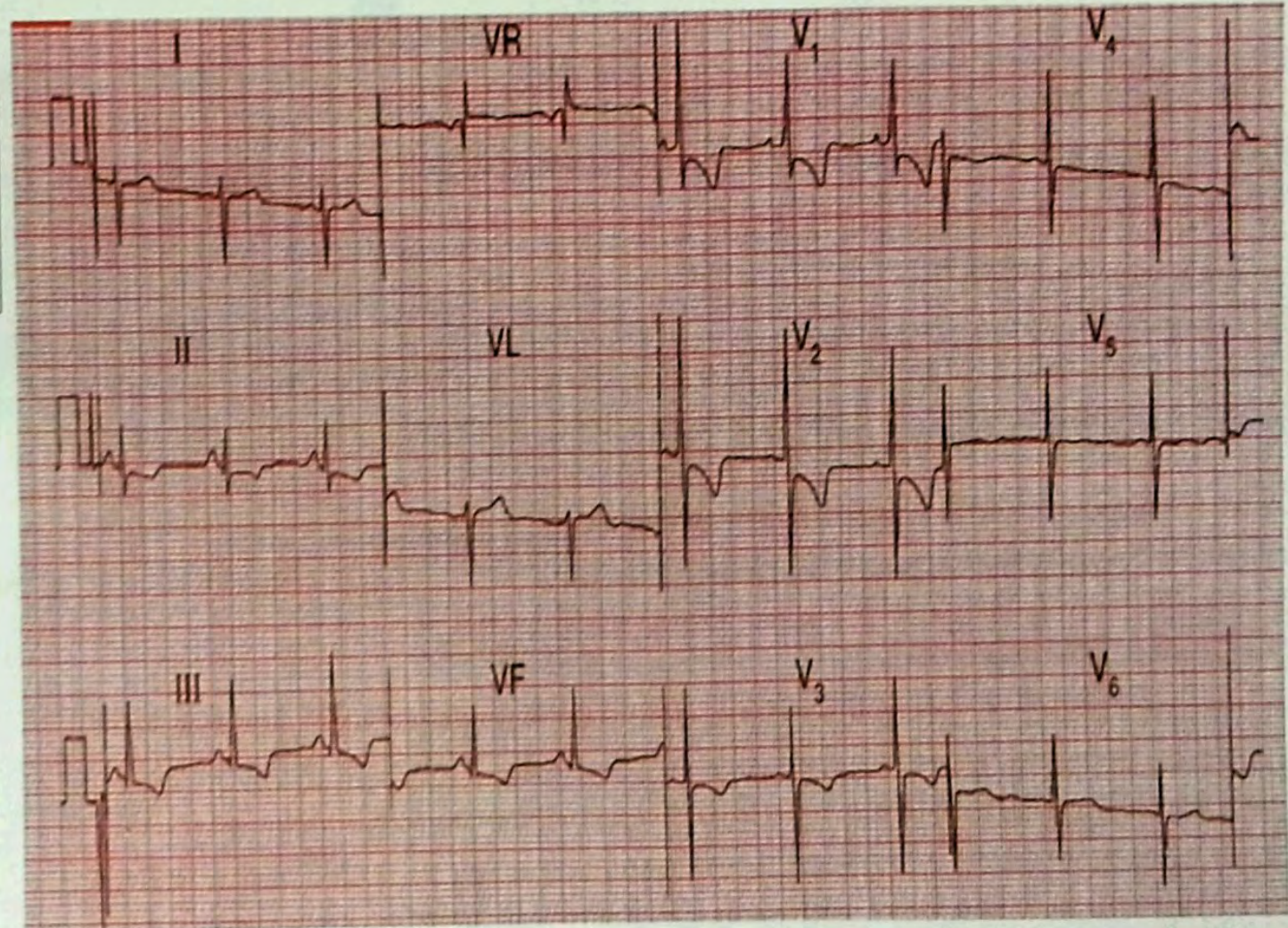
Answer: Third degree (complete) heart block

Report for complete ECG :

1. Rhythm
2. Rate
3. Axis
4. Lead II & (Lead I for LPHB)
 - P wave
 - PR interval
 - QRS ; Pathological Q
 - ST segment
 - T wave
 - LAHP
5. (V1 ,V2) & (V5,V6) :
 - BBB
 - VH
 - Pathological Q

Case History:

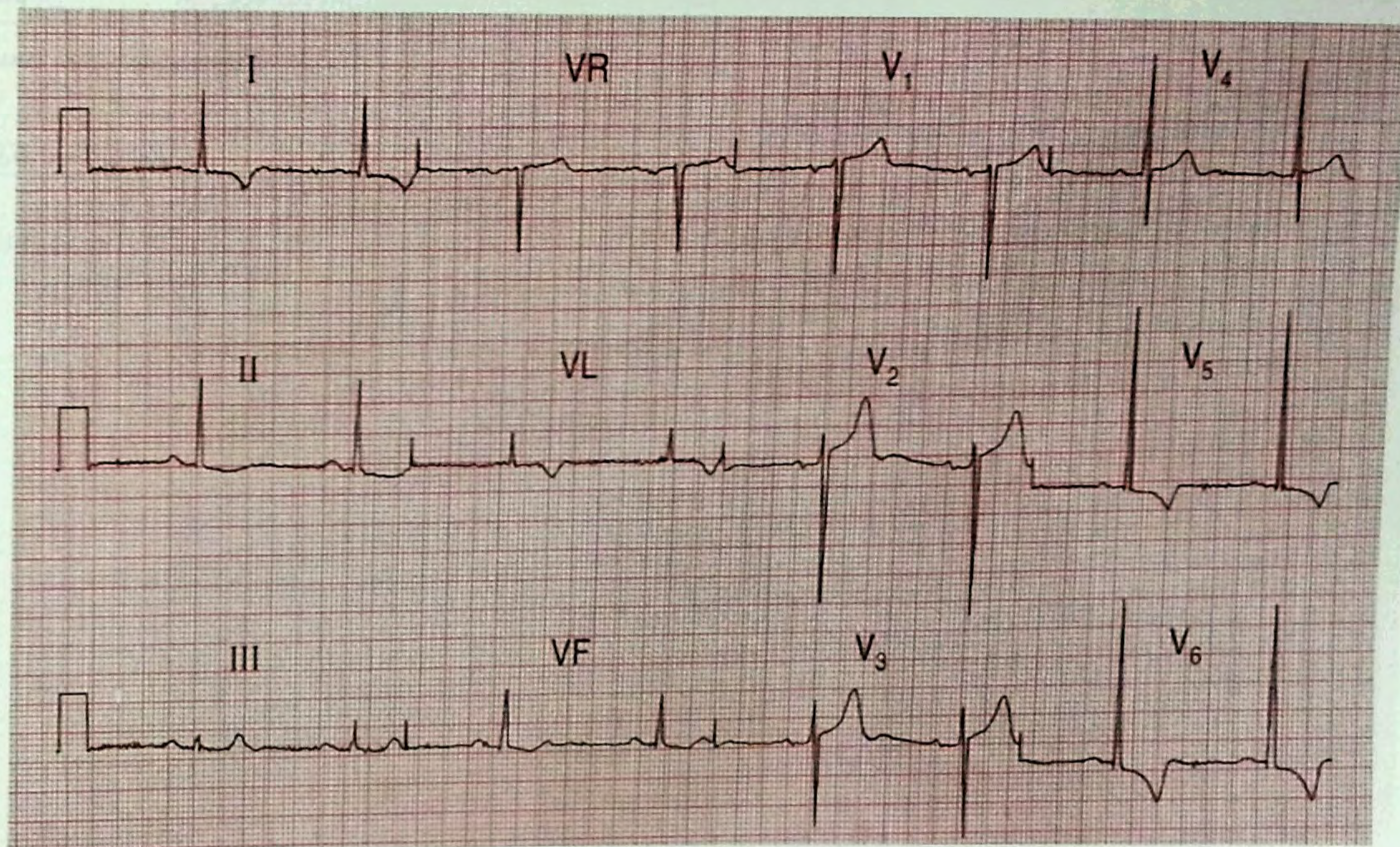
A 40 year old woman is referred to the outpatient department because of increasing breathlessness.



Report	Diagnosis
The ECG shows : - Sinus rhythm - Peaked p waves , best seen in lead II - Right Axis Deviation (RAD) - Dominant R waves in lead V1 - Deep S waves in lead V6 - Inverted T waves in leads II , III , aVF , V1-V3	Severe right ventricular hypertrophy

Case History:

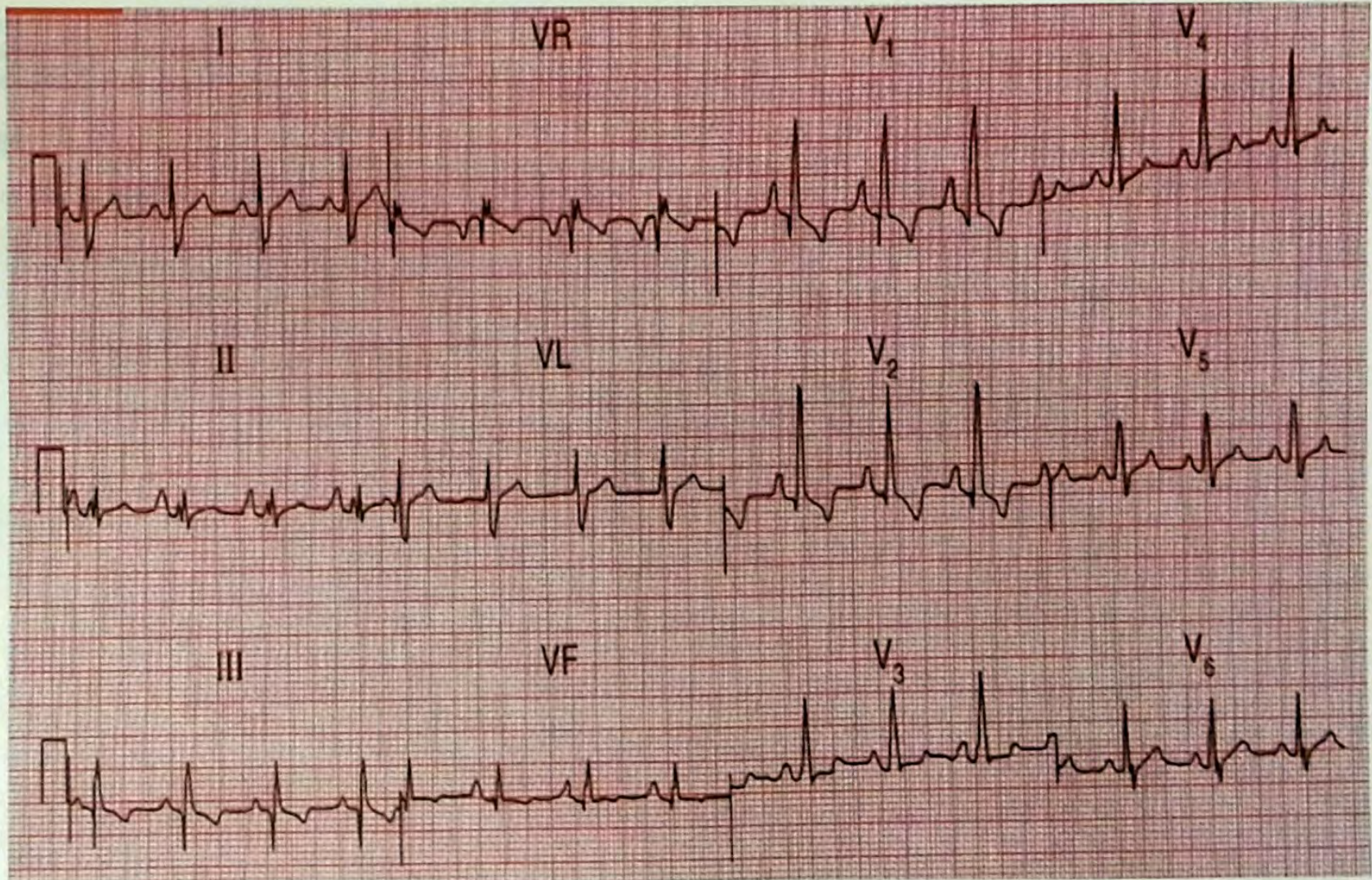
A 70 year old retired orthopedic surgeon telephones to say that he always gets dizzy playing golf. You find that he has a systolic murmur.



Report	Diagnosis
The ECG shows : - Sinus rhythm , rate 48/min - Normal axis - QRS complex duration normal, but the R wave height in lead V5 is more than 25 mm , and the S wave depth in lead V2 is more than 25 mm - Inverted T waves in leads I , aVL , V5-V6	Left ventricular hypertrophy

Case History:

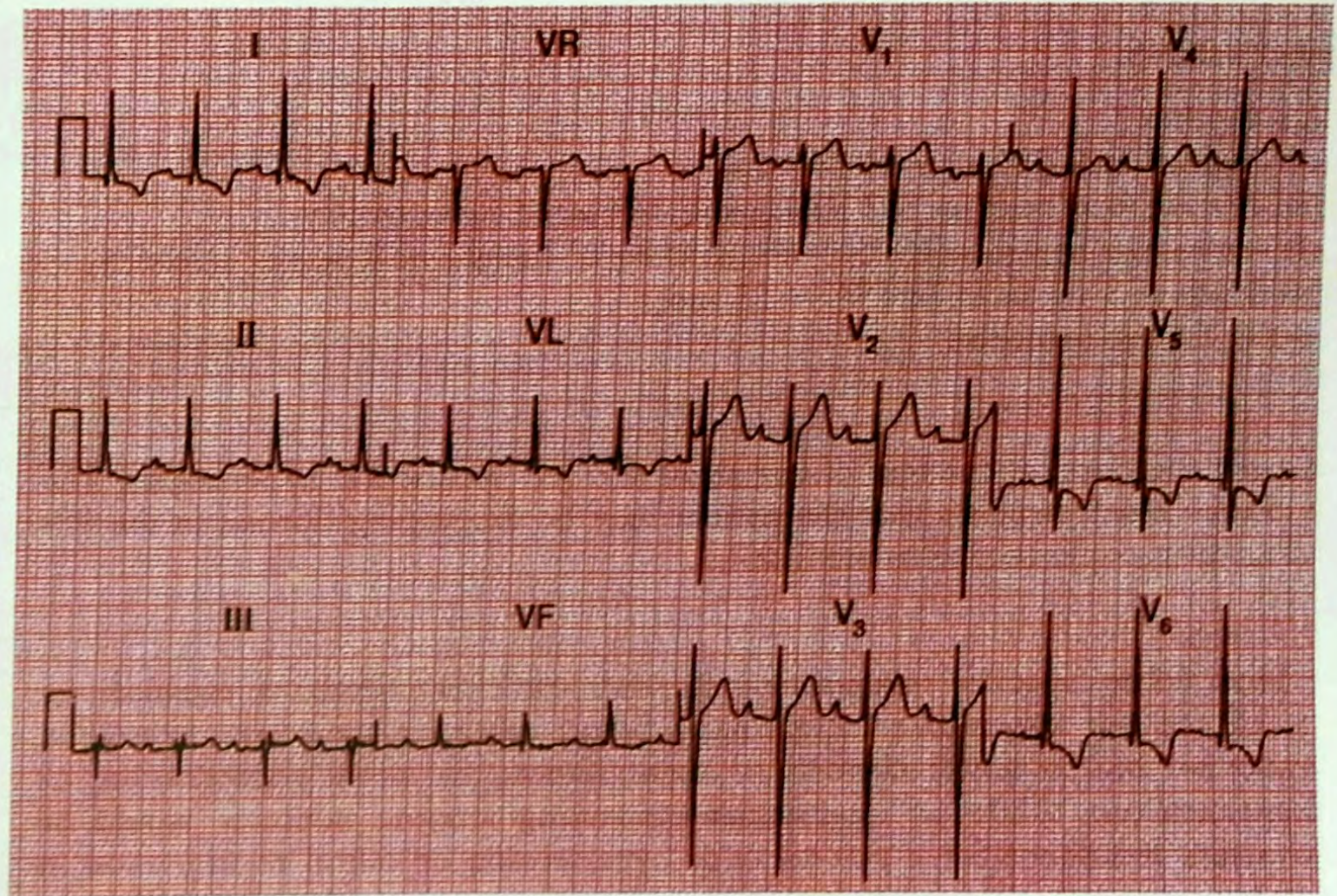
This ECG recorded from a 17 year old girl who was breathless, hand marked ankle swelling with signs of right heart failure, and who had been known to have a heart murmur since birth. She was acyanotic.



Report	Diagnosis
The ECG shows : - Sinus rhythm - Markedly peaked P waves , best seen in leads II , V1 - Normal axis - Dominant R wave in lead V1	Right atrial and right ventricular hypertrophy

Case History:

This ECG was recorded from a 60 year old man admitted to hospital with severe heart failure



Report

The ECG shows :

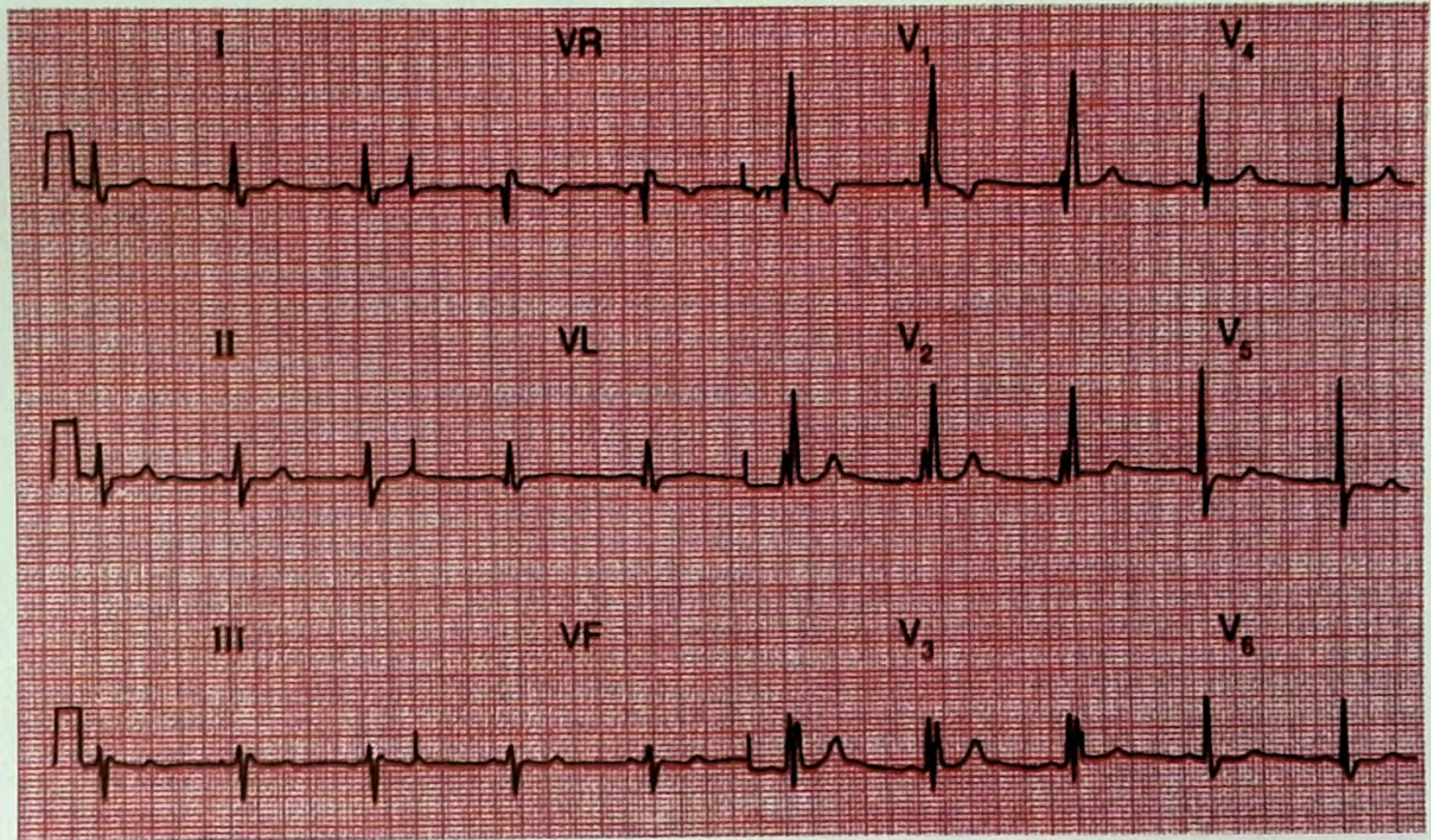
- Sinus rhythm
- First degree heart block (PR interval 280 ms)
- Bifid P wave (best seen in lead II) suggests left atrial hypertrophy
- R wave height in lead V5 is more than 25 mm , and the S wave depth in lead V2 is more than 25 mm suggest left ventricular hypertrophy

Diagnosis

- First degree heart block
- Left atrial hypertrophy
- Left ventricular hypertrophy

Case History:

A 15 year old boy was referred to the outpatient department because of heart murmur. He had no symptoms

**Report**

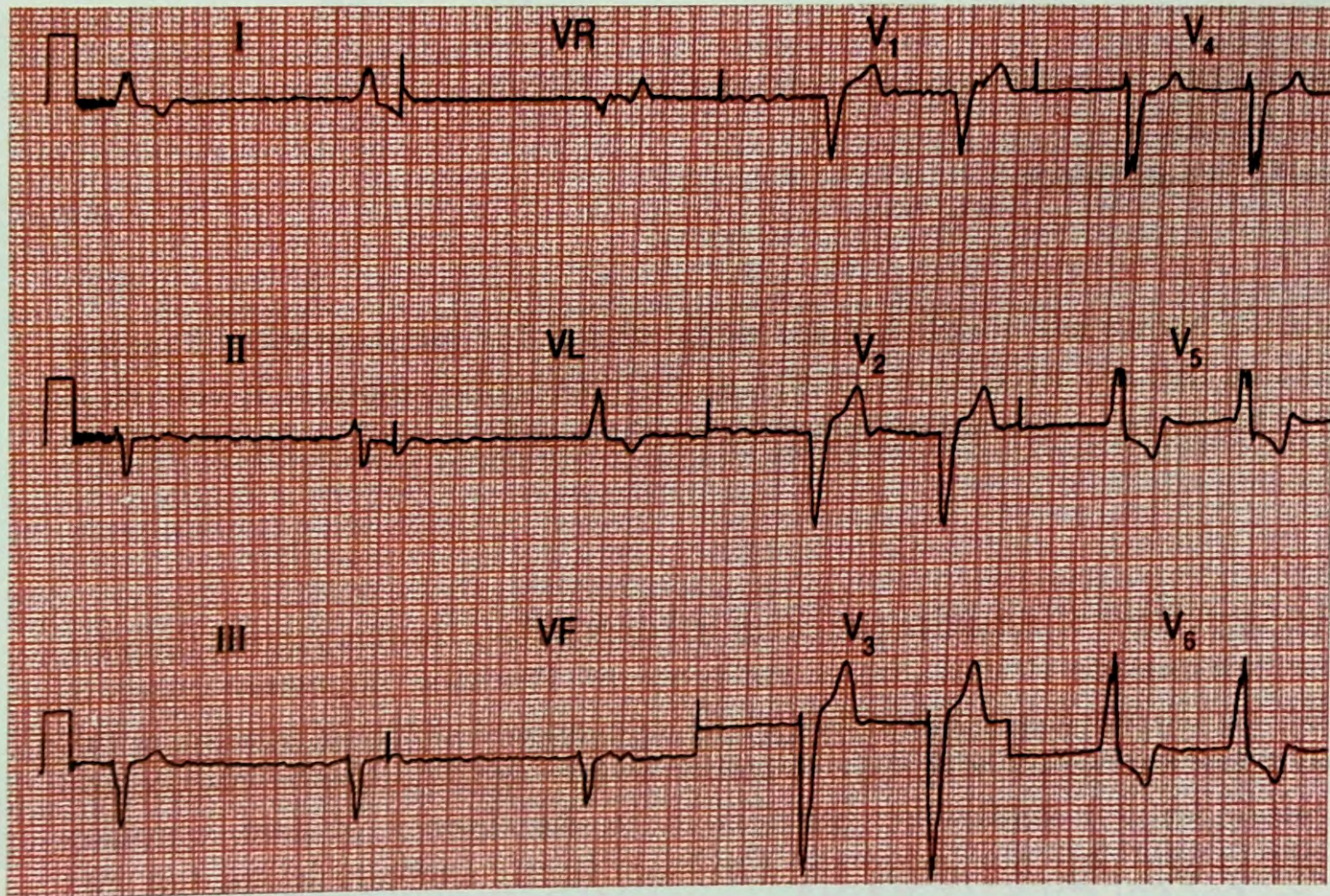
- The ECG shows :
- Sinus rhythm
- Normal axis
- RBBB : Broad (wide) QRS complexes ,RSR' pattern in leads V1 – V3
- Wide and slurred S waves in lead V6
- Normal ST segments and T waves

Diagnosis

Sinus rhythm with right bundle branch block

Case History:

This ECG was recorded from an 80 year old man complained of breathlessness and ankle swelling which had become very slowly over the preceding few months. He had had no chest pain and was on no treatment. He had a slow pulse, and signs of heart failure



Report

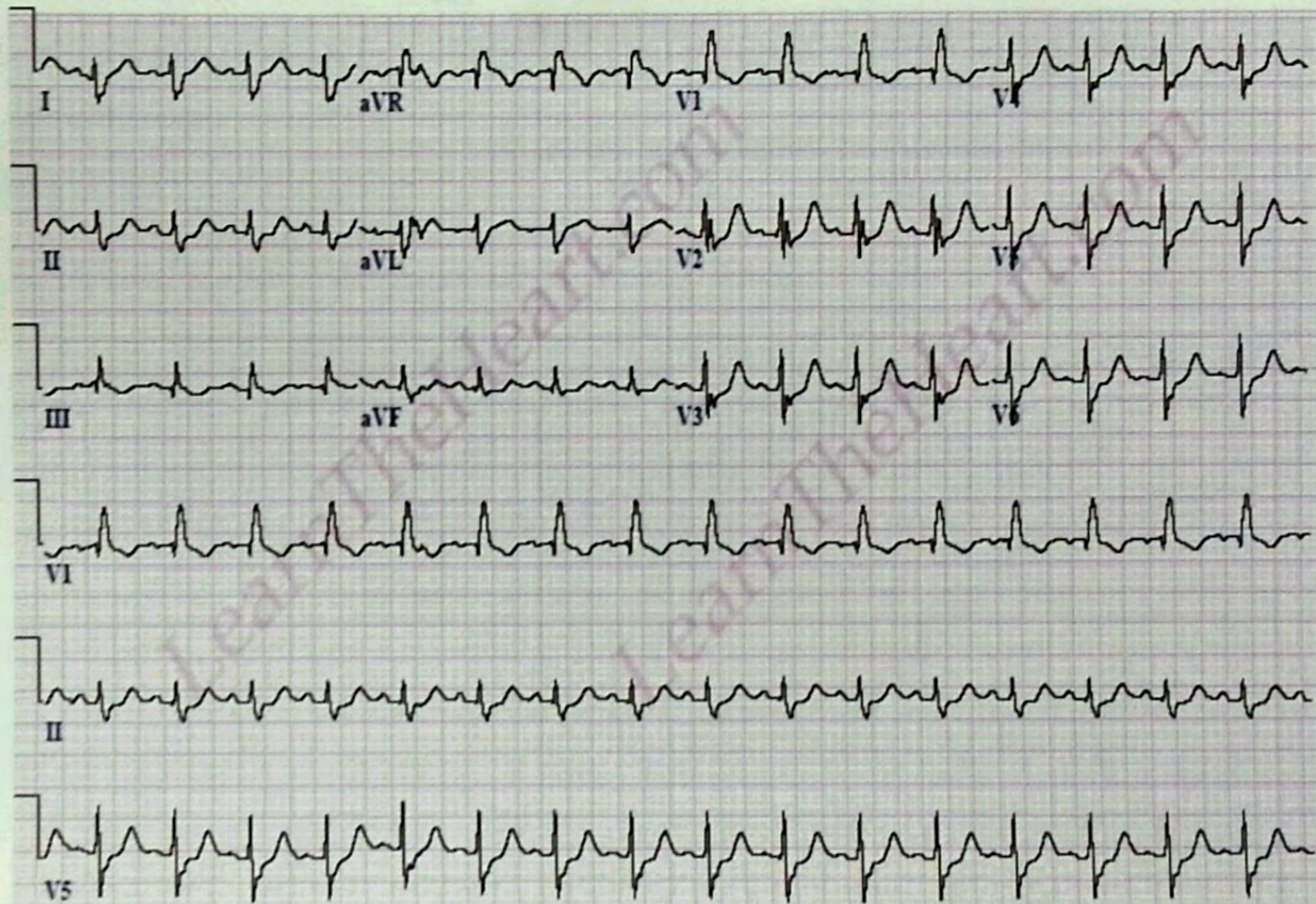
- The ECG shows :
- Atrial fibrillation with a ventricular rate about 40/min
 - Left axis deviation
 - Left bundle branch block : Monophasic notched R in V5 , V6, lead I

Diagnosis

Atrial fibrillation and left bundle branch block

Case History:

An 80 year old woman complained of breathlessness and frequent attacks of dizziness. This was her ECG when she attended the clinic. She lived alone, and it seemed unlikely that she could cope with an ambulatory recorder.



Report

The ECG shows :

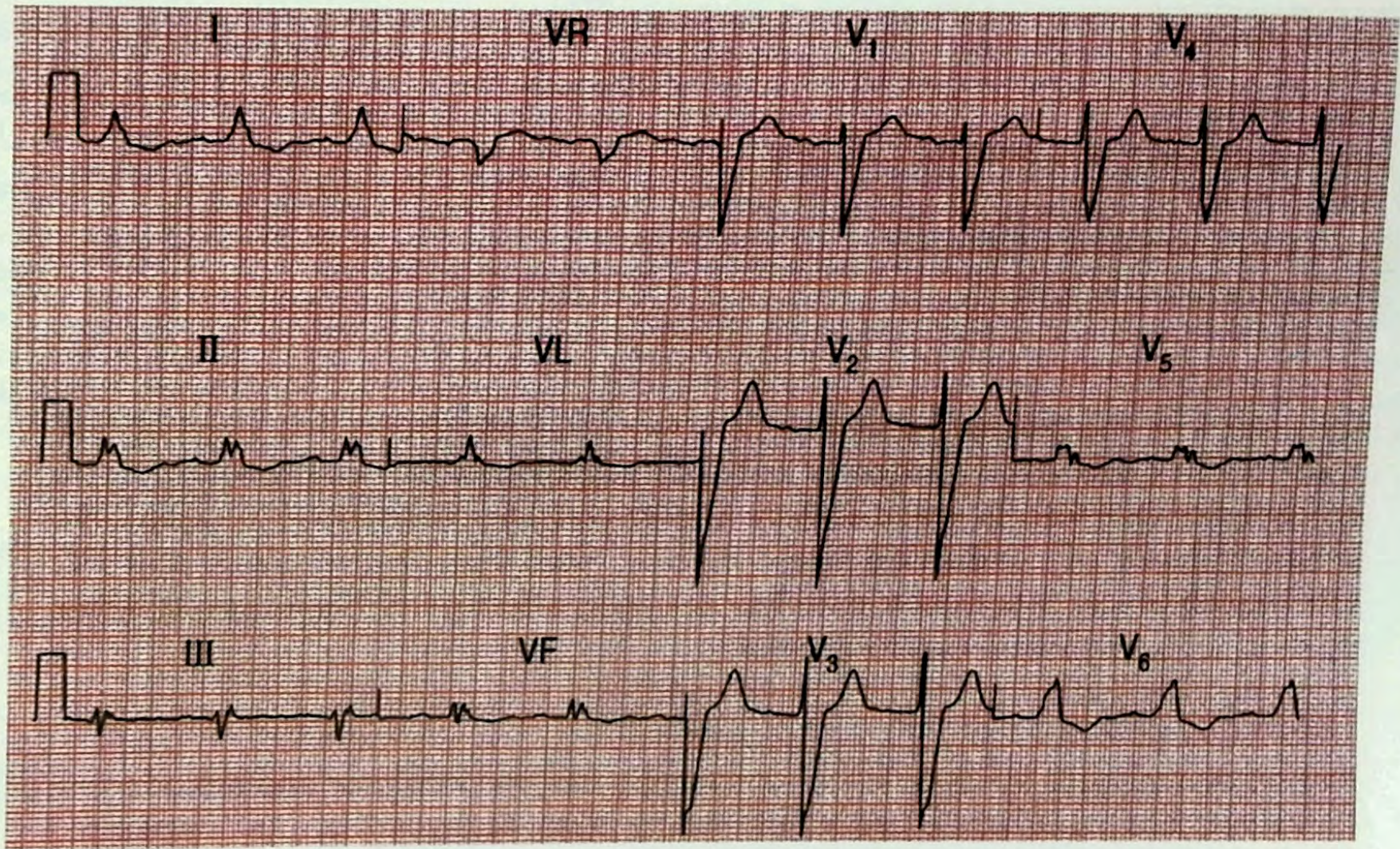
- Sinus rhythm
- Right axis deviation
- Left posterior hemiblock : RAD + Deep S wave in I & aVL
- Right bundle branch block : Broad (wide) QRS complexes , rSR' pattern & monophasic notched tall R , in leads V1 – V3

Diagnosis

Bifascicular block = Left posterior hemiblock + right bundle branch block

Case History:

This ECG was recorded after cardioversion, when the patient was well. His serum troponin level remained normal following the admission, so he had not had myocardial infarction.



Report

The ECG show :

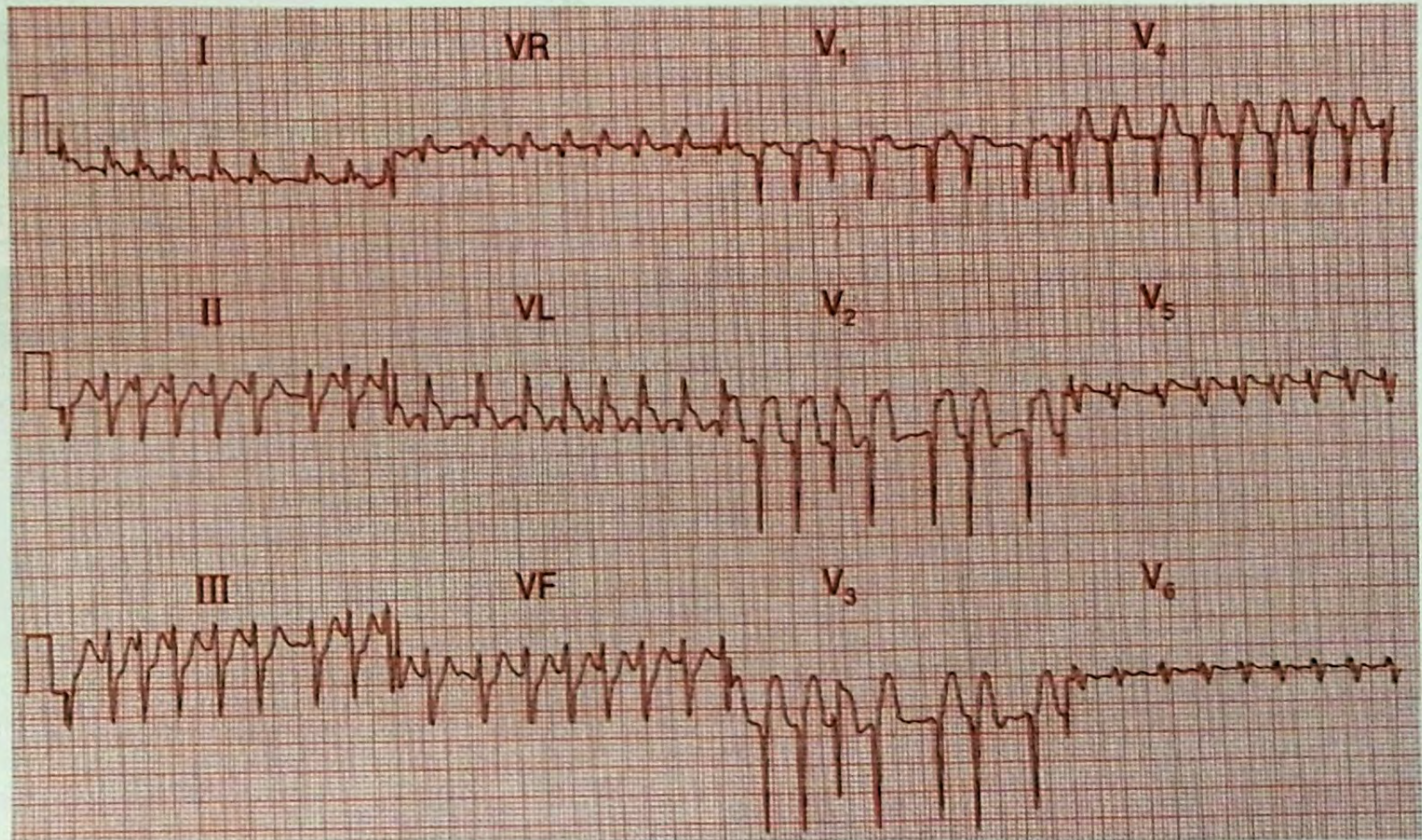
- Sinus rhythm
- First degree block (PR interval 220 ms) : fixed prolonged PR interval
- Normal axis
- Broad QRS complexes (200ms)
- Left bundle branch block : Monophasic notched R in V5 , V6, lead I

Diagnosis

First degree heart block and Left bundle branch block

Case History:

This ECG recorded from diabetic man who was admitted because of the sudden onset of pulmonary edema



Report

The ECG shows :

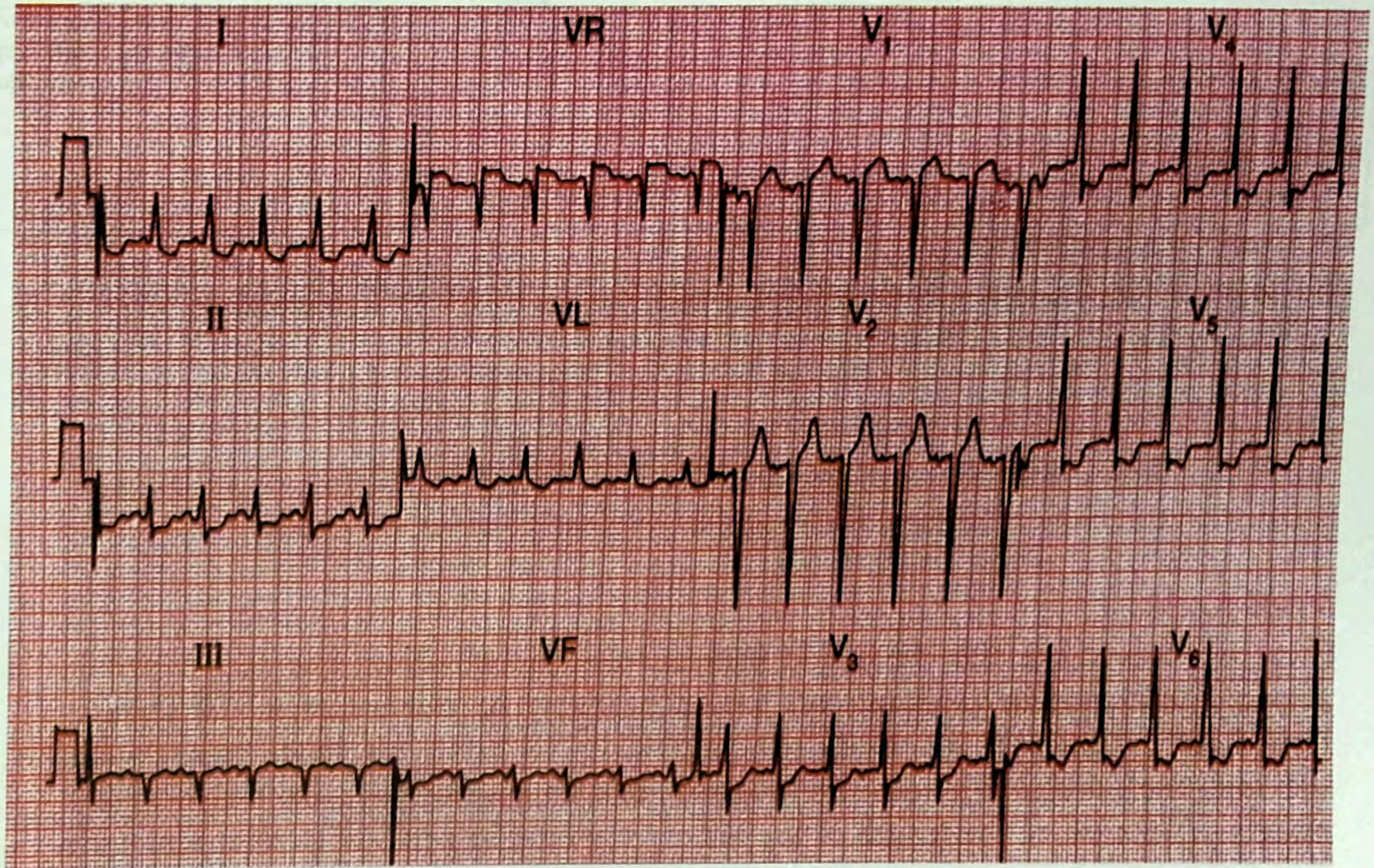
- Atrial fibrillation with a ventricular rate about 180/min
- Left axis deviation
- Deep S in lead II , III , avF
- QRS complexes of normal width and height
- Pathological Q in V2 - V4
- Raised ST segment in leads I , VL, V2-V4

Diagnosis

Atrial fibrillation , left anterior hemiblock and acute anterolateral myocardial infarction

Case History:

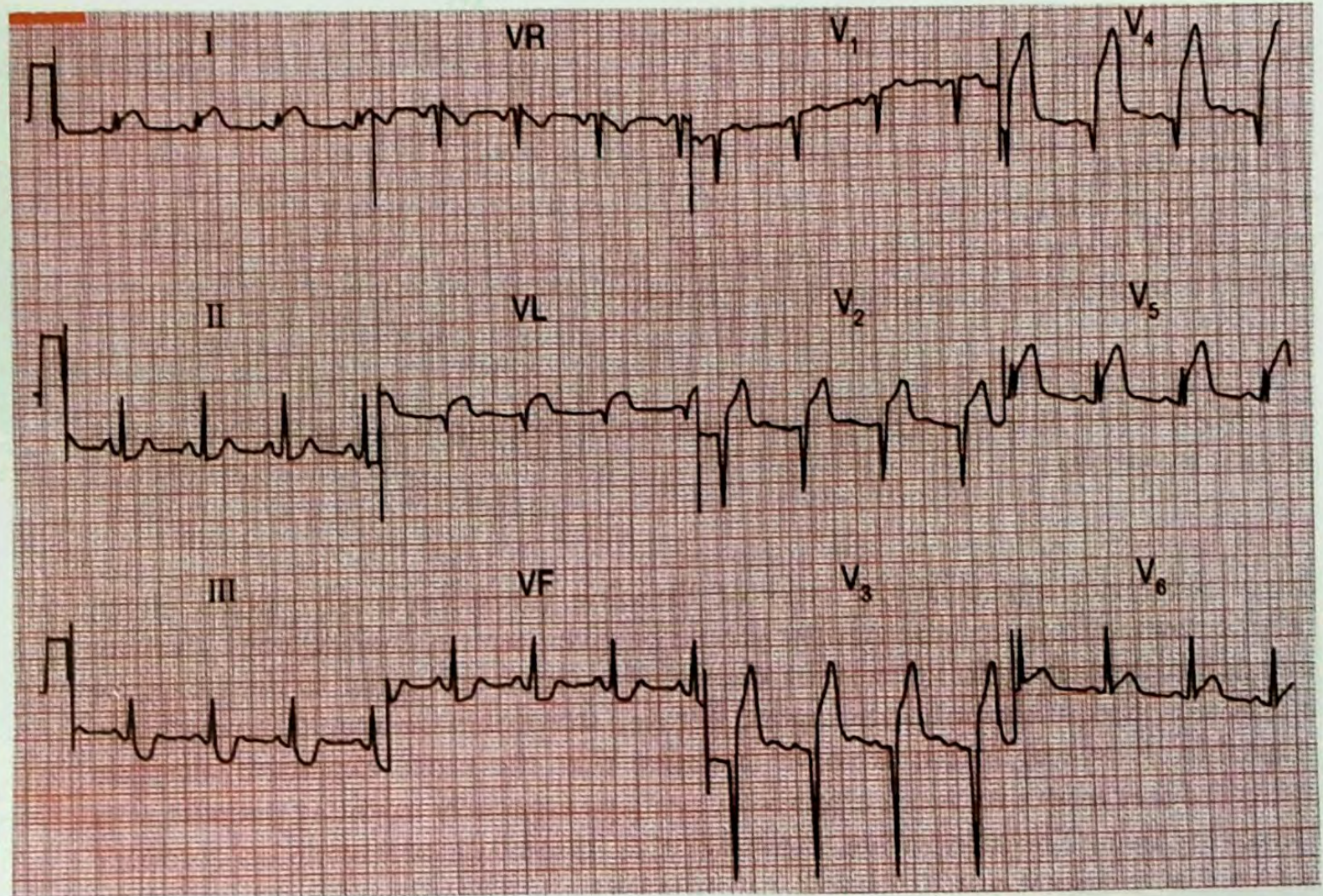
This ECG recorded from 55 year old man who had had chest pain at rest for 6 hours. There were no physical findings and his plasma troponin level was normal.



Report	Diagnosis
The ECG shows: - Sinus rhythm - Normal axis - Normal QRS complex - ST segment depression – horizontal in leads V3, V4, downward sloping in leads I, aVL, V5-V6	Anterolateral ischemia

Case History:

A 45 year old patient is admitted to the accident and emergency department, having severe central chest pain for 1 hour. There are no signs of heart failure.

**Report**

The ECG shows :

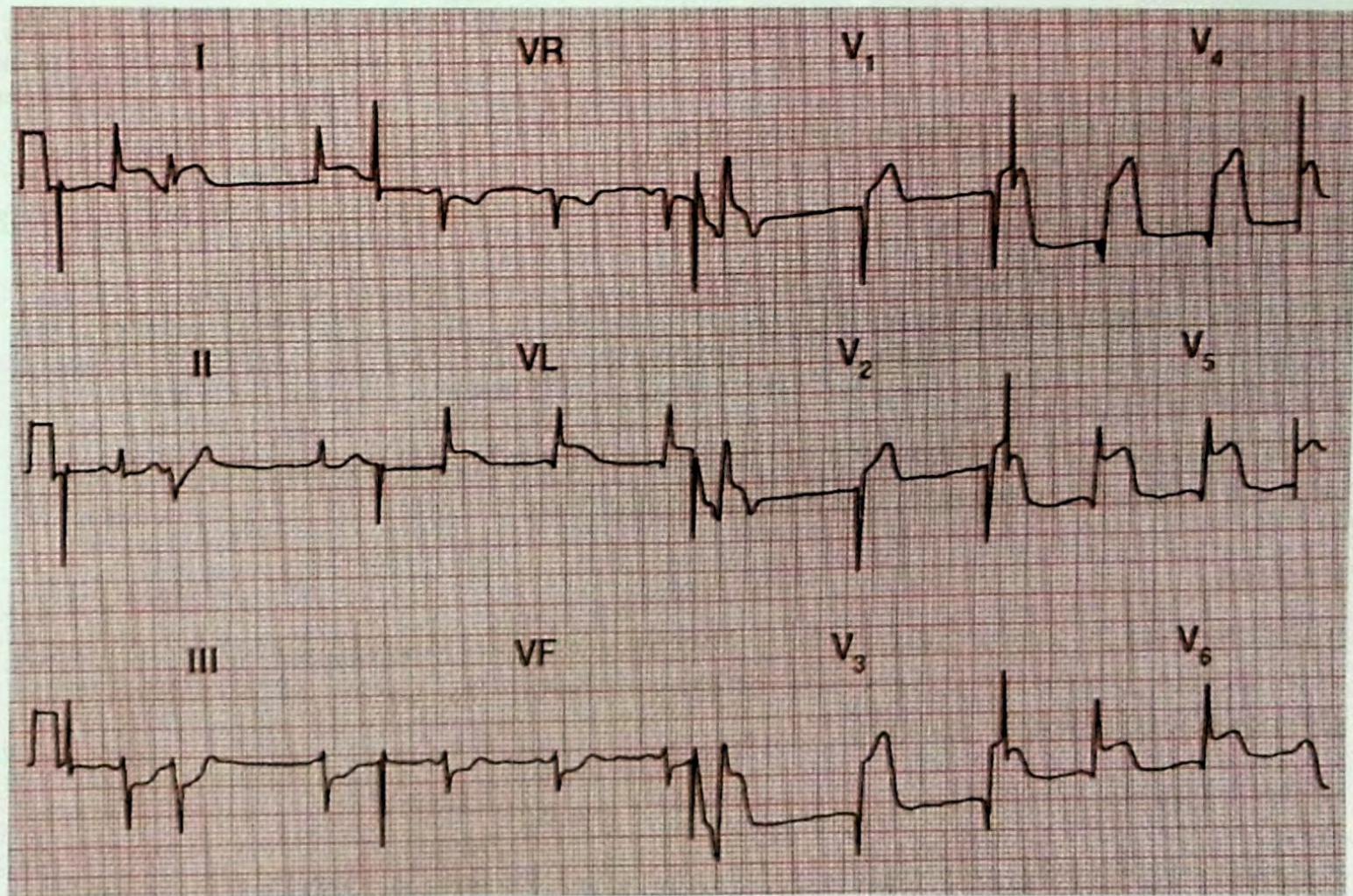
- Sinus rhythm
- Normal axis
- Pathological Q waves in leads V2-V4
- Raised ST segments in leads I, aVL, V2-V5
- ST segment depression in leads II, III, aVF

Diagnosis

Acute anterior myocardial infarction and inferior ischemia

Case History:

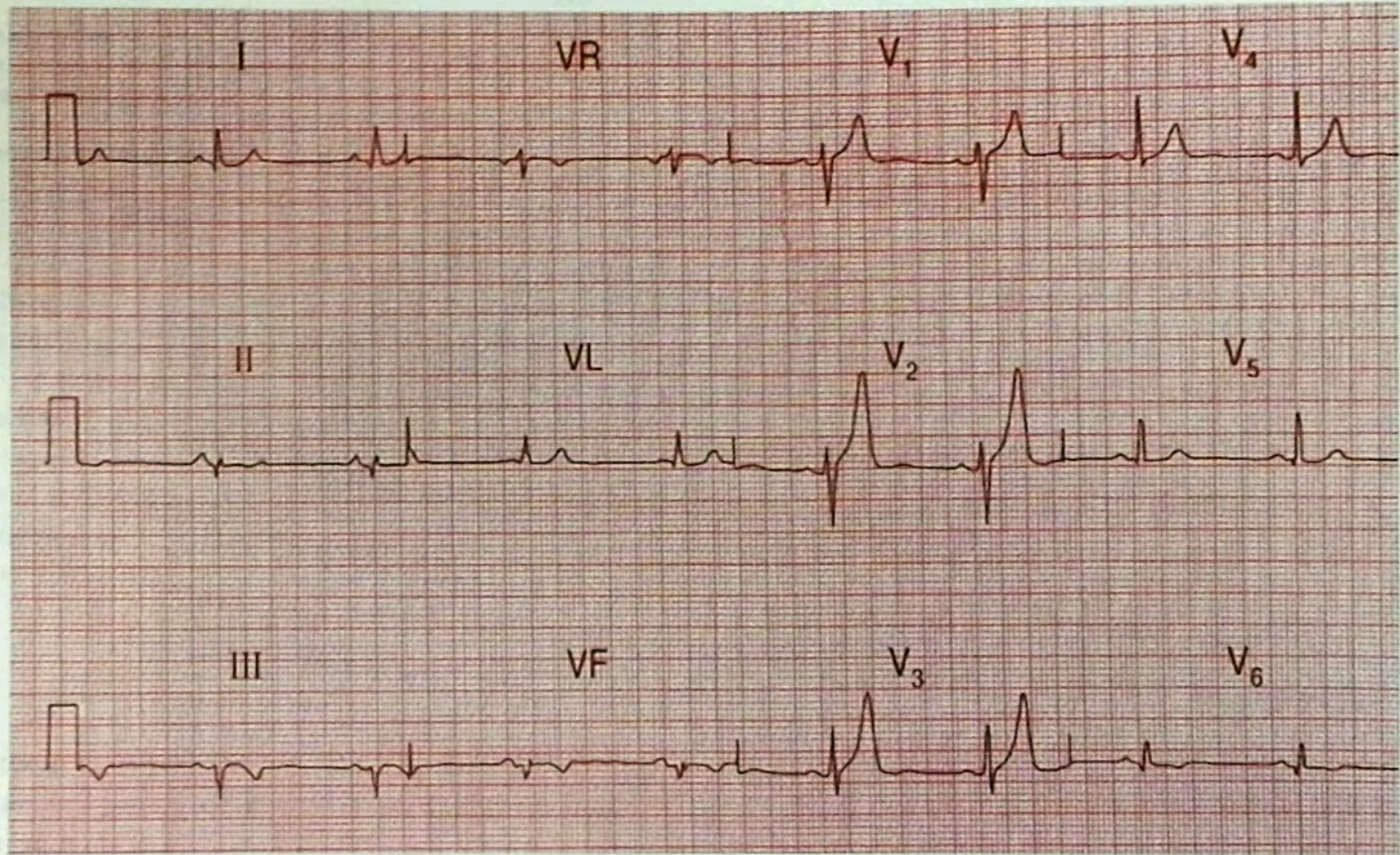
This ECG was recorded from a 50 year old man who had had severe chest pain for 1 h.



Report	Diagnosis
The ECG shows : - Sinus rhythm with ventricular extrasystoles - Normal axis - Pathological Q waves in leads V3-V5 - Raised ST segments in leads I , avL , V3-V6 - Depressed ST segments in leads III , avF	Acute ST segment anterolateral myocardial infarction with ventricular extrasystoles

Case History:

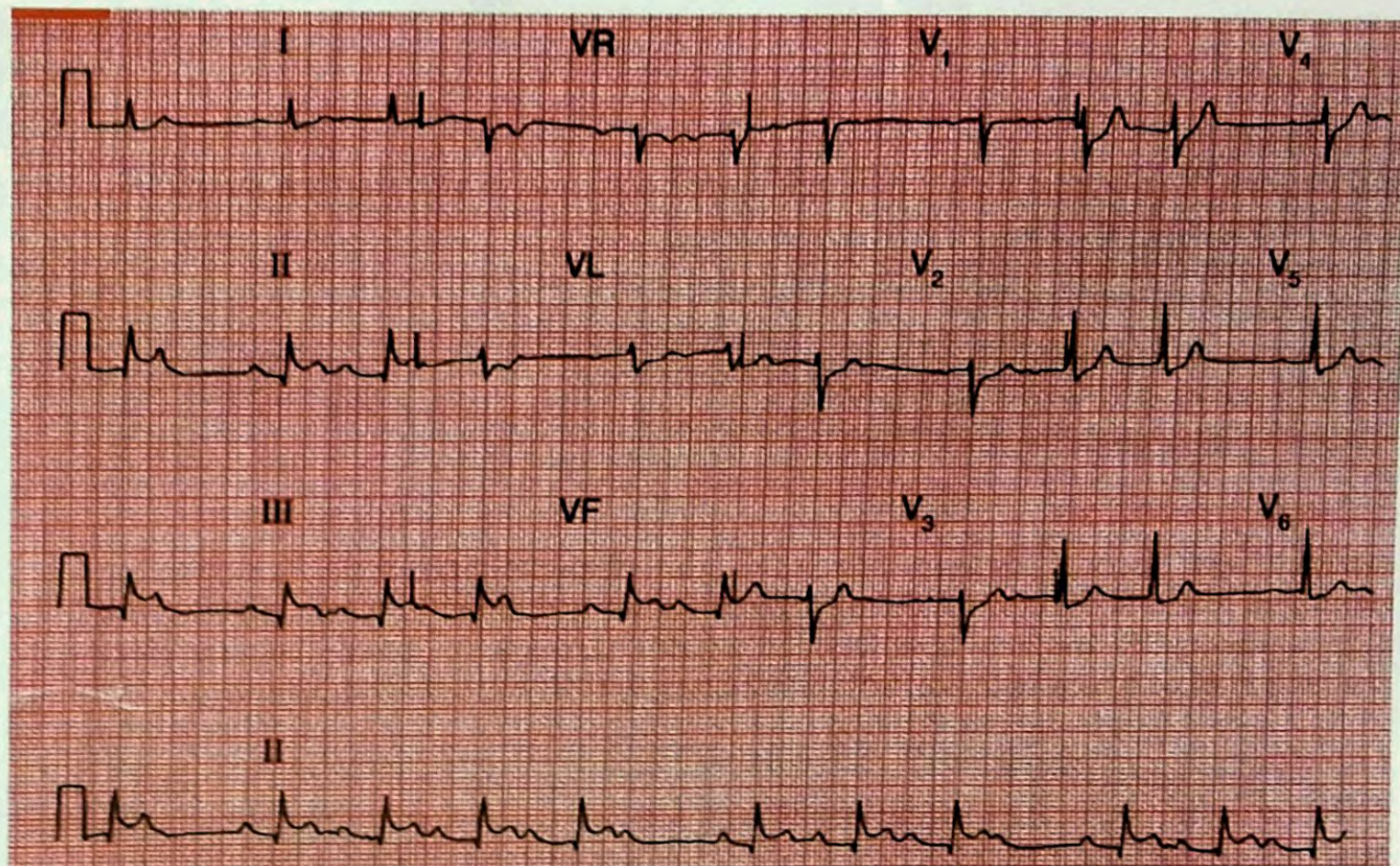
A 60 year old man was seen as an outpatient, complaining of rather vague central chest pain on exertion. He had never had pain at rest.



Report	Diagnosis
The ECG shows: - Sinus rhythm - Normal axis - Pathological small Q waves in leads II , III , aVF - Biphasic T waves in leads II , V6; inverted T waves in leads III , aVF - Marked peaked T waves in leads V1-V2	Old inferior myocardial infarction NB : the Q waves in the inferior leads, together with inverted T waves, point to an old inferior myocardial infarction. While symmetrically peaked T waves in the anterior leads can be due to hyperkalemia, or to ischemia , they are frequently a normal variant .

Case History:

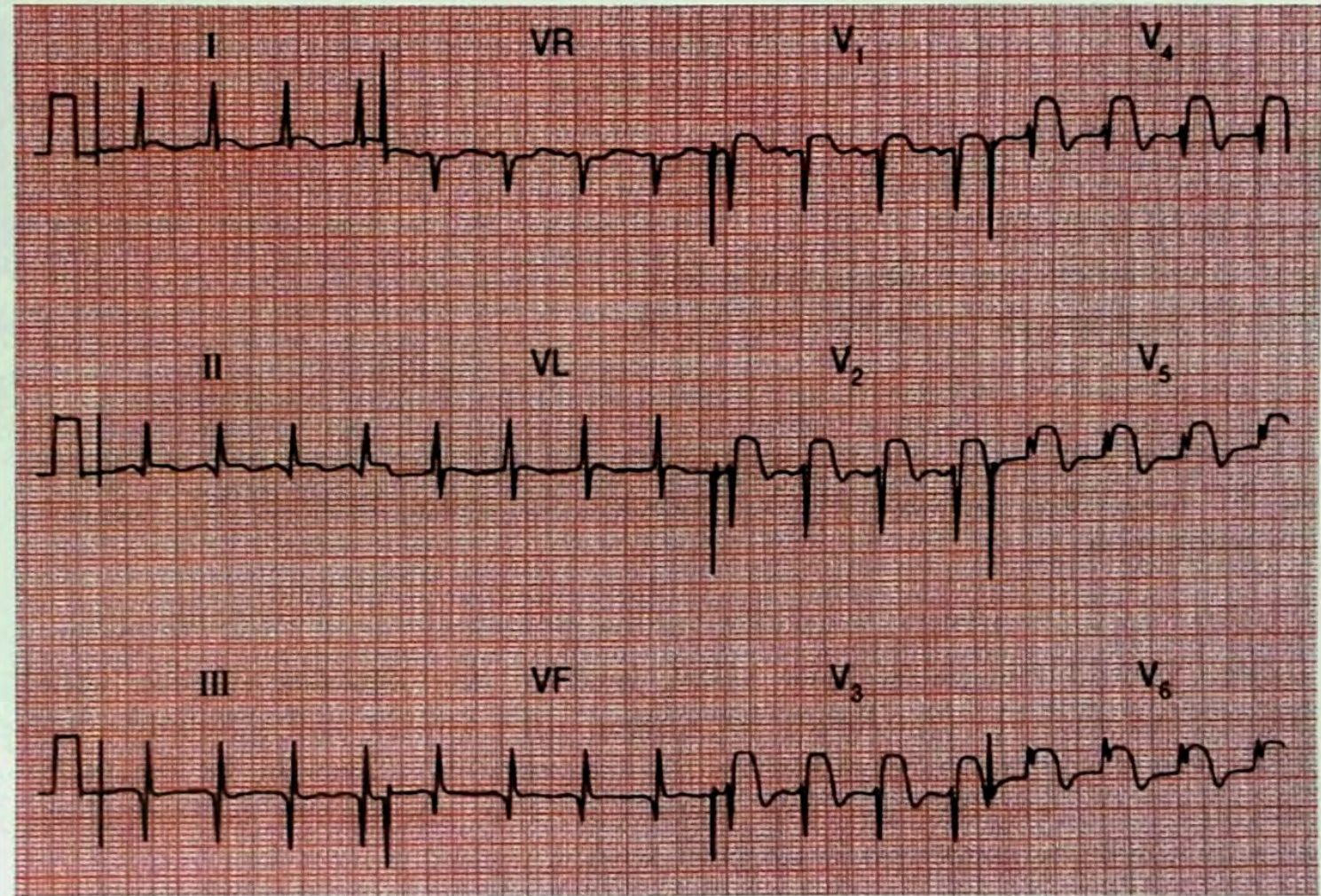
A 70 year old man is admitted to hospital following the onset of severe central chest pain.



Report	Diagnosis
The ECG shows : - Sinus rhythm - Second degree (Wenckebach) heart block (most obvious in rhythm strip recorded from lead II) - Ventricular rate 70/min - Normal axis - Pathological small Q waves in leads II , III , avF - Raised ST segments in leads II , III , avF - Depressed ST segments in leads V5-V6	Second degree (Wenckbach) atrioventricular block with acute inferior myocardial infarction .

Case History:

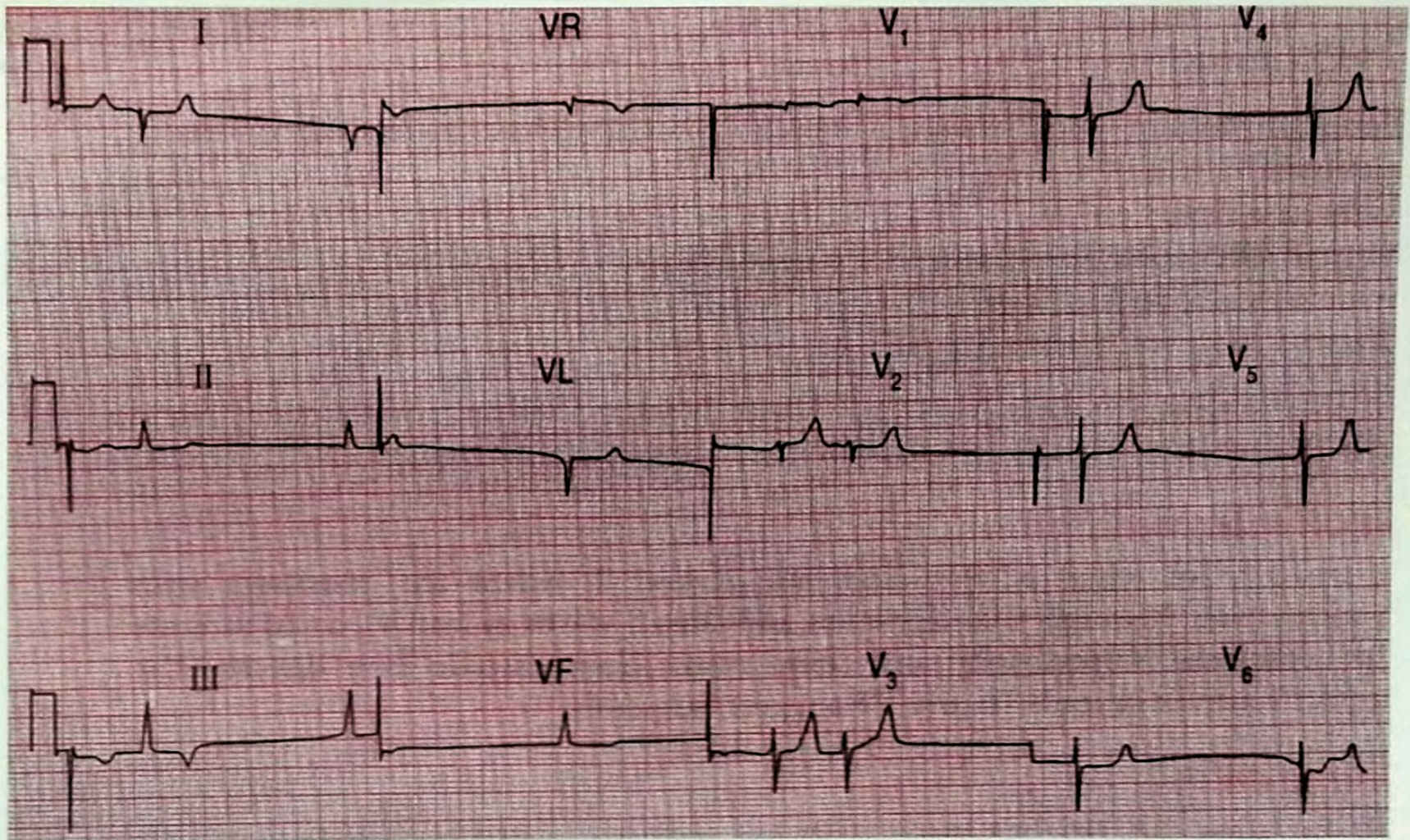
A 60 year old man, who 3 years earlier had had a myocardial infarction followed by mild angina, was admitted to hospital with central chest pain that had been present for 1 hour and had not respond to sublingual nitrates.



Report	Diagnosis
The ECG shows : - Sinus rhythm - Normal axis - Pathological Q waves in leads II , III , avF - Isoelectric ST segment in Leads II , III , avF - Normal QRS complexes in the anterior leads - Pathological Q with Marked ST segment elevation in leads V1-V6	Old inferior infarction and acute anterior infarction

Case History:

A 65 year old woman with rheumatic heart disease, who had had severe heart failure for years, was admitted with increasing breathlessness and ankle swelling. Despite having been treated with ACEI and diuretics, there was evidence of severe heart failure.



Report

The ECG shows

- Uncertain rhythm , no P waves , irregular QRS complex, but no fibrillation activity
- Right axis deviation
- Normal QRS complexes except for deep S wave in lead V6
- Symmetrically peaked T waves
- Inverted T waves in leads III , aVF

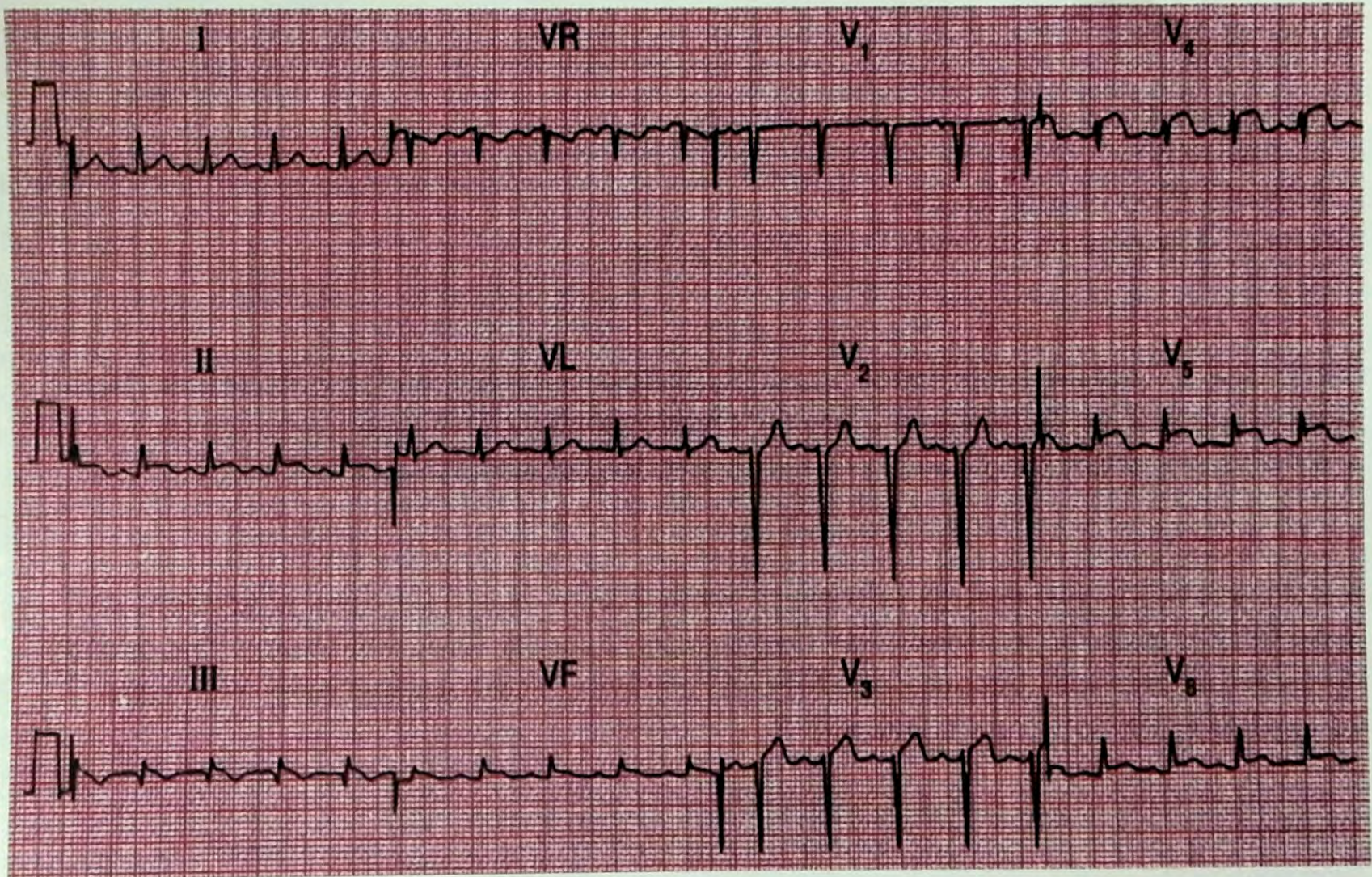
Diagnosis

Hyperkalemia

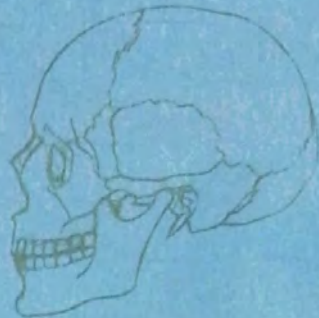
NB: the absence of atrial activity and the peaked T waves are consistent with hyperkalemia. The right axis deviation and the deep S waves in lead V6 could indicate right ventricular hypertrophy. The inverted T waves in leads III , aVF suggest ischemia

Case History:

A 25 year old man is admitted to the accident and emergency with severe chest pain. No physical abnormalities had been detected.



Report	Diagnosis
The ECG shows : - Sinus rhythm - Normal axis - Normal QRS complexes - Raised ST segments in leads I-III , aVF , V4-V6	Wide spread ST segment elevation , suggesting pericarditis



OTHER AVAILABLE BOOKS
BY THE AUTHOR :
ESSENTIALS FOR SIXTH YEAR

- * Internal Medicine : THEORETICAL
- * Internal Medicine : Clinical
- * Psychiatry
- * Dermatology
- * ECG
- * X-Rays Of Internal Medicine
- * Clinical Pathology

& More.....

University Book Centre
Sayed Mahmoud
103 matehaf el maniel-cairo
tel.:01223698600 01091111168